55-1520-236-10

TM 55-1520-236-10

TECHNICAL MANUAL

OPERATOR'S MANUAL

ARMY MODEL
AH-1S (PROD)
AH-1S (ECAS)
AH-1S (MODERNIZED COBRA)
HELICOPTERS

This copy is a reprint which includes current pages from Changes 1 through 17

This manual supersedes TM 55-1520-236-10, 29 April 1977, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY
11 JANUARY 1980

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TM 55-1520-236-10
C 17

CHANGE
NO. 17

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 6 February 1989

Operator's Manual

ARMY MODEL AH-1P (PROD)
AH-1E (ECAS), AH-1F (MODERNIZED COBRA) HELICOPTERS

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Operator's Manual

ARMY MODEL AH-1P (PROD)
AH-1E (ECAS), AH-1F (MODERNIZED COBRA) HELICOPTERS

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9-1 and 9-2	9-1 and 9-2

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TM 55-1520-236-10
C 15

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NO. 15 }

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WASHINGTON, D.C., 16 May 1988

Operator's Manual

ARMY MODEL AH-1P (PROD)
AH-E (ECAS), AH-1F (MODERNIZED COBRA) HELICOPTERWS

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TM 55-1520-236-10
C 14

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NO. 14

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WASHINGTON, D.C., 12 April 1988

Operator's Manual

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8-9 through 8-12	8-9 through 8-12

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TM 55-1520-236-10
C 13

CHANGE
NO. 13

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Operator's Manual

ARMY MODEL AH-1P (PROD)
AH-1E (ECAS), AH-1F (MODERNIZED COBRA) HELICOPTERS

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4-42.1/4-42.1	4-42.1/4-42.2
4.2-33 and 4.2-34	4.2-33 and 4.2-34
8-9 and 8-10	8-9 and 8-10

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No. 12

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Operator's Manual

ARMY MODEL AH-1P (PROD), AH-1E (ECAS), AH-1F (MODERNIZED COBRA) HELICOPTERS

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Remove pages	Insert pages
a thru c/d	a thru c/d
i thru iii/iv	i thru iii/iv
1-1 and 1-2	1-1 and 1-2
2-1 thru 2-4	2-1 thru 2-4
2-7 thru 2-12	2-7 thru 2-12
2-17 thru 2-22	2-17 thru 2-22
2-29 thru 2-38	2-29 thru 2-38
---	2-38.1/2-38.2
2-39 and 2-40	2-39/2-40
2-41 and 2-42	2-41 and 2-42
2-47 and 2-48	2-47 and 2-48
2-48.1 and 2-48.2	2-48.1 and 2-48.2
2-51 and 2-52	2-51 and 2-52
2-52.1/2-52.2	---
2-53 thru 2-55/2-56	2-53 and 2-54
3-1 thru 3-4	3-1 thru 3-4
3-7 and 3-8	3-7 and 3-8
---	3-8.1 thru 3-8.3/3-8.4
3-9 and 3-10	3-9 and 3-10
---	3-10.1 and 3-10.2
---	3-12.1 and 3-12.2
3-19 and 3-20	3-19 and 3-20
3-20.1/3-20.2	3-20.1/3-20.2
3-23 thru 3-26	3-23 thru 3-26
---	3-26.1/3-26.2
3-29 thru 3-32	3-29 thru 3-31/3-32
4-1 and 4-2	4-1 and 4-2
4-2.1 and 4-2.2	4-2.1 and 4-2.2
4-5 thru 4-8	4-5 thru 4-8
4-8.1/4-8.2	4-8.1/4-8.2
4-9 and 4-10	4-10
---	4-12.1/4-12.2
4-13 thru 4-24	4-13 thru 4-24
4-24.1/4-24.2	4-24.1 and 4-24.2

Remove pages	Insert pages
4-25 thru 4-28	4-25 thru 4-28
4-31 and 4-32	4-31 and 4-32
4-32.1/4-32.2	4-32.1 and 4-32.2
4-33 thru 4-36	4-33 thru 4-36
4-37 and 4-38	4-37 and 4-38
4-41 and 4-42	4-41 and 4-42
---	4-42.1/4-42.2
4.1-1 and 4.1-2	4.1-1 and 4.1-2
4.1-9 and 4.1-10	4.1-9 and 4.1-10
4.1-19 thru 4.1-22	4.1-19 thru 4.1-22
4.1-27 thru 4.1-32	4.1-27 thru 4.1-32
4.2-1 and 4.2-2	4.2-1 and 4.2-2
4.2-11 and 4.2-12	4.2-11/4.2-12
4.2-13 and 4.2-14	4.2-13 and 4.2-14
4.2-21 thru 4.2-24	4.2-21 thru 4.2-24
4.2-29 thru 4.2-34	4.2-29 thru 4.2-34
5-1 thru 5-3/5-4	5-1 thru 5-3/5-4
5-5 and 5-6	5-5
5-7 and 5-8	5-8
5-9 and 5-10	5-9 and 5-10
6-1 thru 6-12	6-1 thru 6-12
---	6-12.1 thru 6-12.20
6-13 thru 6-16	6-13 thru 6-16
6-19 thru 6-22	6-19
6.1-1 thru 6.1-31	---
7-1 and 7-2	7-1 and 7-2
7-5 thru 7-7/7-8	7-5
7-9 and 7-10	7-9 and 7-10
---	7-10.1/7-10.2
7-13 and 7-14	7-13 and 7-14
7-17 and 7-18	7-17 and 7-18
---	7-18.1 thru 7-18.3/7-18.4
7-19 and 7-20	7-19 and 7-20
7-25 and 7-26	7-25 and 7-26
7-45 thru 7-48	7-45 thru 7-48
7-51/7-52	7-51/7-52
7.1-1 and 7.1-2	7.1-1 and 7.1-2
7.1-5 thru 7.1-7/7.1-8	7.1-5
7.1-9 and 7.1-10	7.1-9 and 7.1-10
7.1-13 and 7.1-14	7.1-13 and 7.1-14
7.1-19 and 7.1-20	7.1-19 and 7.1-20
7.1-25 and 7.1-26	7.1-25 and 7.1-26
7.1-45 thru 7.1-48	7.1-45 thru 7.1-48
7.1-51/7.1-52	7.1-51/7.1-52
8-1 thru 8-28.1/8-28.2	8-1 thru 8-20
9-1 thru 9-17/9-18	9-1 thru 9-13/9-14
A-1 and A-2	A-1 and A-2
B-3 and B-4	B-3 and B-4

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Operator's Manual

ARMY MODEL AH-1S (PROD)
AH-1S (ECAS), AH-1S (MODERNIZED COBRA) HELICOPTERS

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9-13 and 9-14	9-13 and 9-14
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9-15 and 9-16	9-15 and 9-16
- - -	9-16.1/9-16.2 Blank

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HEADQUARTERS
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Operator's Manual

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2-1 through 2-4	2-1 through 2-4
2-7 through 2-10	2-7 through 2-10
2-33 and 2-34	2-33 and 2-34
2-37 and 2-38	2-37 and 2-38
2-45 and 2-46	2-45 and 2-46
2-49 and 2-50	2-49 and 2-50
3-3 and 3-4	3-3 and 3-4
4-1 and 4-2	4-1 and 4-2
4-2.1 through 4-2.3/4-2.4	4-2.1 through 4-2.5/4-2.6
4-33 and 4-34	4-33 and 4-34
8-7 through 8-12	8-7 through 8-12
- - -	8-28.1/8-28.2

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Operator's Manual

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AH-1S (ECAS), AH-1S (MODERNIZED COBRA) HELICOPTERS

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5-7 through 5-10	5-7 through 5-10
8-21 through 8-24	8-21 through 8-24
- - - -	8-24.1 and 8-24.2
9-9 through 9-12	9-9 through 9-12

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	Remove pages	Insert Pages
Chapter 4	4-31 and 4-32	4-31 and 4-32
Chapter 4.1	4.1-27 and 4.1-28	4.1-27 and 4.1-28
	4.2-29 and 4.2-30	4.2-29 and 4.2-30

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ARMY MODEL AH-1S (PROD) AH-1S (ECAS), AH-1S (MODERNIZED COBRA) HELICOPTERS

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1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Warning	a thru c/d	a thru c/d
Table of Contents	i and ii	i and ii
Chapter 2	2-1 thru 2-6	2-1 thru 2-6
	2-25 and 2-26	2-25 and 2-26
	2-47 thru 2-48.1/2-48.2	2-47 thru 2-48.2
	2-49 thru 2-52	2-49 thru 2-52
Chapter 3	3-19 and 3-20	3-19 thru 3-20.1/3-20.2
Chapter 4	4-1 and 4-2	4-1 and 4-2
	4-3 and 4-4	4-3 and 4-4
	4-7 and 4-8	4-7 and 4-8
	4-13 and 4-14	4-13 and 4-14
	4-21 and 4-22	4-21 and 4-22
	4-29 and 4-30	4-29 and 4-30
	4-41 and 4-42	4-41 thru 4-43/4-44
Chapter 4.1	4.1-1 and 4.1-2	4.1-1 and 4.1-2
	4.1-7 and 4.1-8	4.1-7 and 4.1-8
	4.1-19 and 4.1-20	4.1-19 and 4.1-20
	4.1-23 and 4.1-24	4.1-23 and 4.1-24
	4.1-31 and 4.1-32	4.1-31 thru 4.1-33/4.1-34
Chapter 4.2	4.2-1 and 4.2-2	4.2-1 and 4.2-2
	4.2-7 thru 4.2-10	4.2-7 thru 4.2-10
	4.2-21 and 4.2-22	4.2-21 and 4.2-22
	4.2-27 and 4.2-28	4.2-27 and 4.2-28
	---	4.2-35/4.2-36
Chapter 5	5-1 and 5-2	5-1 and 5-2
	5-5 and 5-6	5-5 and 5-6
	5-9 and 5-10	5-9 and 5-10
Chapter 6	6-5 and 6-6	6-5 and 6-6
Chapter 7	7-15 thru 7-20	7-15 thru 7-20
Chapter 7.1	7.1-15 thru 7.1-18	7.1-15 thru 7.1-18
	7.1-51/7.1-52	7.1-51/7.1-52
Chapter 8	8-3 thru 8-8	8-3 thru 8-8
	8-27 and 8-28	8-27 and 8-28
Chapter 9	9-1 and 9-2	9-1 and 9-2
	9-3 thru 9-6	9-3 thru 9-6
	9-9 thru 9-17/9-18	9-9 thru 9-17/9-18
Index	Index 1 thru Index 4	Index 1 thru Index 4
	Index 7 and Index 8	Index 7 and Index 8
	Index 11 and Index 12	Index 11 and Index 12

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WASHINGTON, D.C., 22 December 1982

Operator's Manual

ARMY MODEL AH-1S (PROD), AH-1S (ECAS), AH-1S (MODERNIZED COBRA) HELICOPTERS

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1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 9	9-13 and 9-14	9-13 and 9-14

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Operator's Manual

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AH-1S (ECAS), AH-1S (MODERNIZED COBRA) HELICOPTERS

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1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Warning	a thru c/d	a thru c/d
Table of Contents	i and ii	i and ii
Chapter 1	1-1 and 1-2	1-1 and 1-2
Chapter 2	2-1 thru 2-4	2-1 thru 2-4
	2-11 and 2-12	2-11 and 2-12
	2-21 and 2-22	2-21 and 2-22
	2-27 and 2-28	2-27 and 2-28
	2-33 and 2-34	2-33 and 2-34
	2-41 thru 2-44	2-41 thru 2-44
	2-47 and 2-48	2-47 thru 2-48.1/2-48.2
	2-49 and 2-50	2-49 and 2-50
	-	2-52.1/2-52.2
Chapter 3	3-3 and 3-4	3-3 and 3-4
	3-15 thru 3-20	3-15 thru 3-20
	3-25 and 3-26	3-25 and 3-26
	-	3-33 and 3-34
Chapter 4	4-1 and 4-2	4-1 thru 4-2.3/4-2.4
	4-7 and 4-8	4-7 thru 4-8.1/4-8.2
	4-13 thru 4-18	4-13 thru 4-18
	4-23 and 4-24	4-23 thru 4-24.1/4-24.2
	4-25 and 4-26	4-25 and 4-26
	4-31 and 4-32	4-31 thru 4-32.1/4-32.2
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	4-37 and 4-38	4-37 thru 4-38.1/4-38.2
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2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain these sheets in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

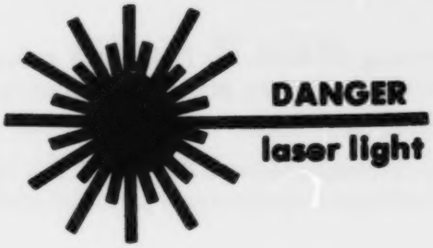
Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Operator Maintenance requirements for AH-1S (PROD) aircraft.

WARNING

Personnel performing operations, procedures, and practices which are included or implied in this manual shall observe the following warnings. Disregard of these warnings and precautionary information can cause serious injury or loss of life. Procedures outlined in paragraph 1-6, AR 40-46 are applicable.



The M-65 Laser Range Finder is very dangerous. Looking at the laser beam or its reflection from a shiny surface can cause permanent blindness. Under non-combat conditions, the laser shall be used only in controlled areas and at times specified by a range control officer. The laser filter in the telescopic sight shall be used in any area where lasers are in use.

STARTING ENGINE

Coordinate all cockpit actions with ground observer. Ensure that rotors and blast area are clear and fire guard is posted.

GROUND OPERATION

Engine will be started and helicopter operated only by authorized personnel. Reference AR95-1.

GROUNDING HELICOPTER

The helicopter should be electrically grounded when parked and will be grounded during refueling operations.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotrifluoromethane (CF_3Br) extinguishing agent or decomposition products should be avoided. The agent should not be allowed to come into contact with the skin, as it may cause frostbite or low-temperature burns.

When helicopter is to be parked where ambient temperature equals or exceeds 90°F (32°C), the fire extinguisher shall be removed until the next mission.

Should an extinguisher be left in the helicopter inadvertently during a high temperature period, the extinguisher shall be weight checked prior to the next mission.

ARMAMENT

Loaded weapons, or weapons being loaded or unloaded, shall be pointed in a direction which offers the least exposure to personnel or property in the event of an accidental firing. Personnel should remain clear of a hazardous area (forward or aft) of all loaded weapons. Any rotation of the 7.62mm machine gun barrels or pushing the turret grenade launcher aft may cause the weapon to fire. Rocket igniter arms shall remain in contact with rockets, when loaded, to reduce possibility of ignition due to EMI (electromagnetic interference).

During ground operations, when servicing the turret, the TUR SLEW switch shall be placed in GND TEST position to prevent injury to ground operations servicing personnel. Ground operations servicing personnel shall be clear of dangerous areas prior to any weapons system operation.

All ground run armt checks should be accomplished with the TUR SLEW rate switch in the GND TEST position to prevent any possibility of injuries inflicted on maintenance personnel working in the proximity of the operating aircraft and the turret area.

CANOPY REMOVAL SYSTEM

Ground safety pins shall be installed in pilot and gunner canopy removal arming/firing mechanisms when the helicopter is on the ground. Pilot safety pin shall be removed prior to flight. Safety pins shall be installed during engine shutdown check. Debris may be expelled 50 feet outward when system is actuated. Pilot and gunner helmet visor should be down to prevent eye injury.

VERTIGO

The rotating beacon light should be turned off during flight through clouds to prevent sensation of vertigo as a result of reflections of the light on the clouds.

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of anoxia exist, the crew should immediately ventilate cockpits.

FUEL, OIL AND HYDRAULIC FLUIDS

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary. Prolonged contact may cause a skin rash. Prolonged contact with hydraulic fluid will cause burns. Refer to FM 10-68 when handling fuel.

When handling hydraulic fluid (MIL-H-83282), observe the following:
—Prolonged contact with liquid or mist can irritate eyes and skin.
—After any prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush them immediately with clear water.
—If liquid is swallowed, do not induce vomiting, get immediate medical attention.
—Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator.
—When fluid is decomposed by heating, toxic gases are released.

ELECTROLYTE

Battery electrolyte is harmful to the skin and clothing. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue flushing until medical assistance arrives.

ROTOR BLADES

Personnel shall stay clear of turning main and tail rotor blades. Wind gusts, coast down, or cyclic movement may cause the main rotor blade to flap down below the height of a person. Dangerous winds are created by the main rotor blades when blades are at operating rpm.

NOISE LEVEL

Sound pressure levels in the helicopter during some operating conditions exceed the Surgeon Generals hearing conservation criteria as defined in TB MED 251. Hearing protection devices, such as the aviator helmet, ear plugs, or ear muffs shall be worn by all personnel in and around the helicopter during operation.

WING STORES JETTISON

All jettison safety pins shall be installed when the helicopter is on the ground. Serious injury can result from accidental ground jettison. Safety pins shall be removed prior to flight. Failure to do so will prevent emergency jettison of wing stores.

EM TURRET

When battery power is applied, the turret gun may stow at a very rapid rate and cause personnel injury.

HIGH VOLTAGE

Serious burns and/or electrical shock can result from contact with exposed electrical wire or connections.

RADIOACTIVE MATERIALS

Self-luminous dials contain radioactive materials. If such an instrument is broken or becomes unsealed, avoid personnel contact.

TECHNICAL MANUAL
No. 55-1520-236-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 11 January 1980

OPERATORS MANUAL
ARMY
AH-1P (PROD)
AH-1E (ECAS)
AH-1F (MODERNIZED COBRA)
HELICOPTERS

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find a mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MMD, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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CHAPTER 1

INTRODUCTION

1-1. GENERAL.

These instructions are for use by the operator of the AH-1P/E/F helicopter.

1-2. WARNING, CAUTIONS, AND NOTES DEFINITION.

Warnings, cautions, and notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which it is essential to highlight.

1-3. DESCRIPTION.

This manual contains the best operating instructions and procedures for AH-1P (PROD), AH-1E (ECAS), AH-1F (MC) helicopters under most circumstances. The observance of limitations, performance and weight balance data provided is mandatory. The observance of procedure is mandatory except when modification is required because of multiple emergencies, adverse weather, terrain, etc. Your flying experience is recognized, and therefore, basic flight principles are not included. **THIS MANUAL SHALL BE CARRIED IN THE HELICOPTER AT ALL TIMES.**

1-4. APPENDIX A. REFERENCES.

Appendix A is a listing of official publications cited within the manual applicable to and available for flight crews.

1-5. APPENDIX B. ABBREVIATIONS AND TERMS.

Appendix B provides a glossary of abbreviations and terms used throughout the text.

1-6. INDEX.

The index lists, in alphabetical order, every titled paragraph, figure and table contained in this manual. Chapters 7 and 7.1 performance data have an additional index within each chapter.

1-7. ARMY AVIATION SAFETY PROGRAM.

Reports necessary to comply with the safety program are prescribed in AR 385-40.

1-8. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

For information concerning destruction of Army materiel to prevent enemy use, refer to TM 750-244-1-5.

1-9. FORMS AND RECORDS.

Army aviators flight record and helicopter maintenance records which are to be used by crewmembers are prescribed in DA PAM 738-751 and TM 55-1500-342-23.

1-10. DELETED.

1-11. EXPLANATION OF CHANGE SYMBOLS.

Changes, except as noted below, to the text and tables, including new material on added pages, are indicated by a vertical line in the outer margin extending close to the entire area of the material affected; exception: pages with emergency markings, which consist of black diagonal lines around three edges, may have the vertical line or change symbol placed along the inner margins. Symbols show current changes only. A miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical line in the outer margin, rather than miniature pointing hands, is utilized when there have been extensive changes to an illustration. Change symbols are utilized to indicate changes in the following:

a. Introductory material.

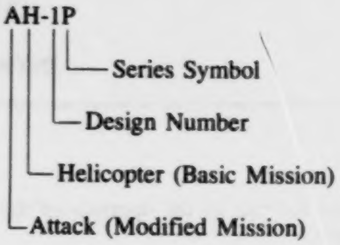
b. Indexes and tabular data where the change cannot be identified.

c. Blank space resulting from the deletion of text, an illustration, or a table.

d. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such correction changes the meaning of instructive information and procedures.

1-12. HELICOPTER DESIGNATION SYSTEM.

The designation system prescribed by AR70-50 is used in helicopter designations as follows:



1-13. SERIES AND EFFECTIVITY CODES.

Designator symbols P (Production), E (Enhanced Cobra Armament System) and M (Modernized Cobra) are used in conjunction with text contents, text headings and illustration titles to show limited effectivity of the material. One or more designator symbols may follow a text heading or illustration title to indicate proper effectivity, unless the material applies to all series and configurations within the manual. Designator symbols precede procedural steps in Chapters 8 and 9. If the material applies to all series and configurations, no designator symbols will be used. Where practical, descriptive information is condensed and combined for all models to avoid duplication.

Designator symbols for different types of main rotor blades are: B540 for the Bell main rotor blade and K747 for the Kaman main rotor blade.

1-14. USE OF SHALL, WILL, SHOULD, AND MAY.

Use "shall" whenever it is necessary to express a provision that is binding. Use "should" and "may" whenever it is necessary to express non-mandatory provisions. "Will may be used to express a declaration of purpose.

CHAPTER 2

HELICOPTER AND SYSTEMS DESCRIPTION AND OPERATION

SECTION I. HELICOPTER

2-1. GENERAL DESCRIPTION.

The AH-1P/E/F helicopter is a tandem seat, two place (pilot and gunner), single engine aerial weapon platform.

a. Fuselage. The fuselage (forward section) employs aluminum alloy skins and aluminum, titanium and fiberglass honeycomb panel construction. Honeycomb deck panels and bulkheads attached to two main beams produce a box-beam structure. These beams make up the primary structure and provide support for the cockpit, landing gear, wings, engine, pylon assembly, fuel cells, and tailboom. The nose section incorporates the turret system and telescopic sight unit.

b. Wing. The fixed cantilever wings have a span of 129 inches (including tip) and a mean chord of 30 inches. The wings provide additional lift and support the wing stores pylon. Each wing has two pylons. The inboard pylons are fixed and the outboard pylons are articulated by hydraulic actuators. An ejector rack is attached to each pylon.

c. Tailboom. The tailboom (aft section) is a tapered semimonocoque structure attached to the forward section by four bolts. The tailboom supports the cambered fin, tail skid, elevators, tail rotor and tail rotor drive system.

d. Main Rotor Blades.

(1) B540 The main rotor blades are metal, bonded assemblies. Each blade is attached in the hub with a retaining bolt assembly and is held in alignment by adjustable drag braces.

(2) K747 The main rotor blades are glass fiber epoxy resin bonded assemblies with a rubber erosion guard. The skin is basket weave which will not be as smooth as a metal blade. Each blade is attached in the hub with a retaining bolt assembly and is held in alignment by adjustable drag braces.

e. Weight Classification. The weight classification of this helicopter is Class 2. (Refer to Chapter 6.)

f. Controls and Indicators. Refer to applicable system for descriptive information.

2-2. GENERAL ARRANGEMENT.

Figure 2-1 shows the general arrangement of the items which are referred to in the exterior check paragraph of Chapter 8, Section 11.

2-3. PRINCIPAL DIMENSIONS.

Figure 2-2 shows the principal dimensions of the helicopter to the nearest inch.

2-4. TURNING RADIUS.

Figure 2-3 shows the minimum turning radius of the helicopter.

2-5. MAIN DIFFERENCES.

Table 2-1 shows the main differences of the AH-1P/E/F helicopters.

2-6. CREW COMPARTMENT DIAGRAMS.

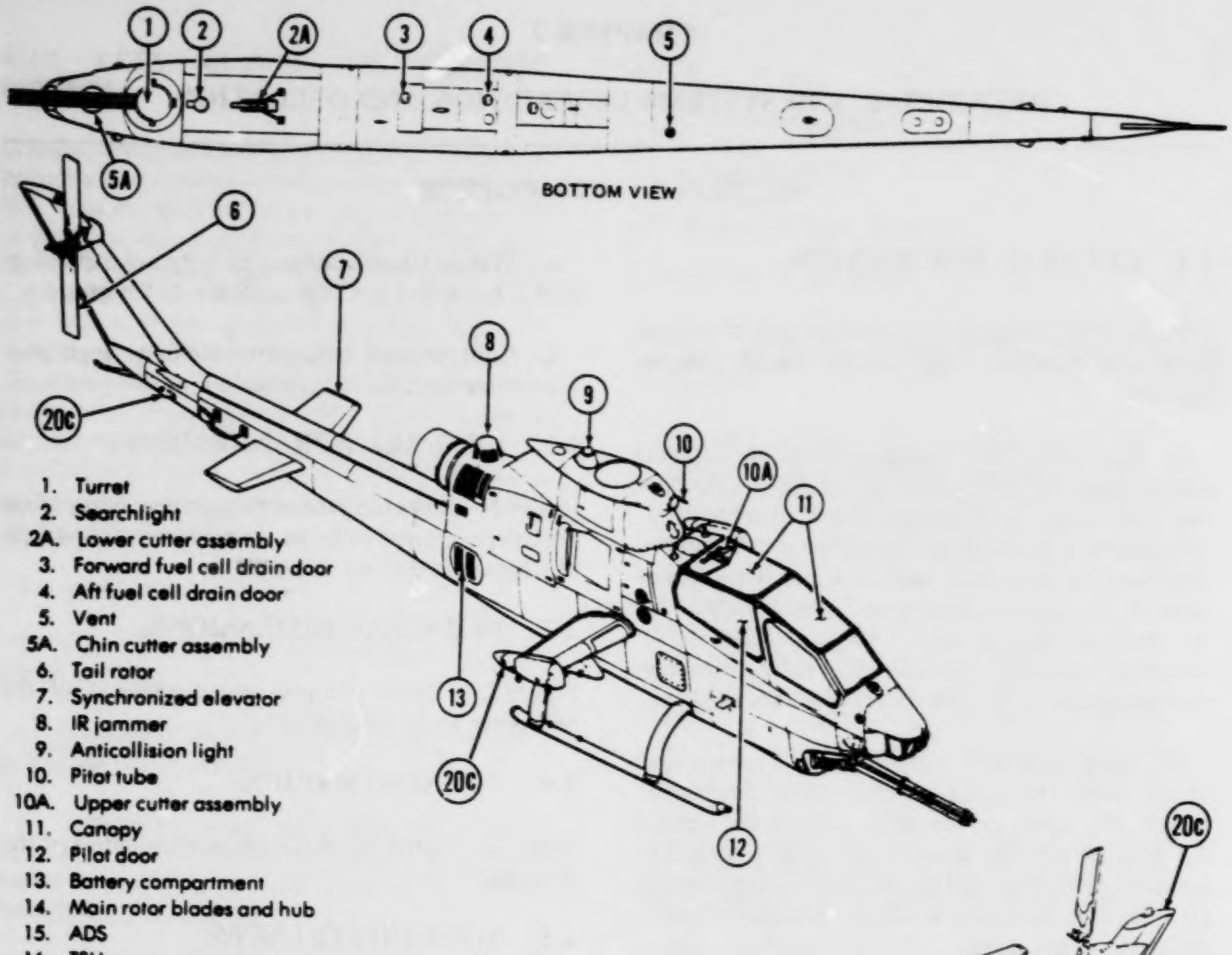
The upper forward portion of the fuselage is the crew compartment. Tandem seating is provided with the pilot elevated in the rear seat.

a. Pilot Station. Figure 2-4 shows the locations of equipment in the pilot station.

b. Gunner Station. Figure 2-5 shows the locations of equipment in the gunner station.

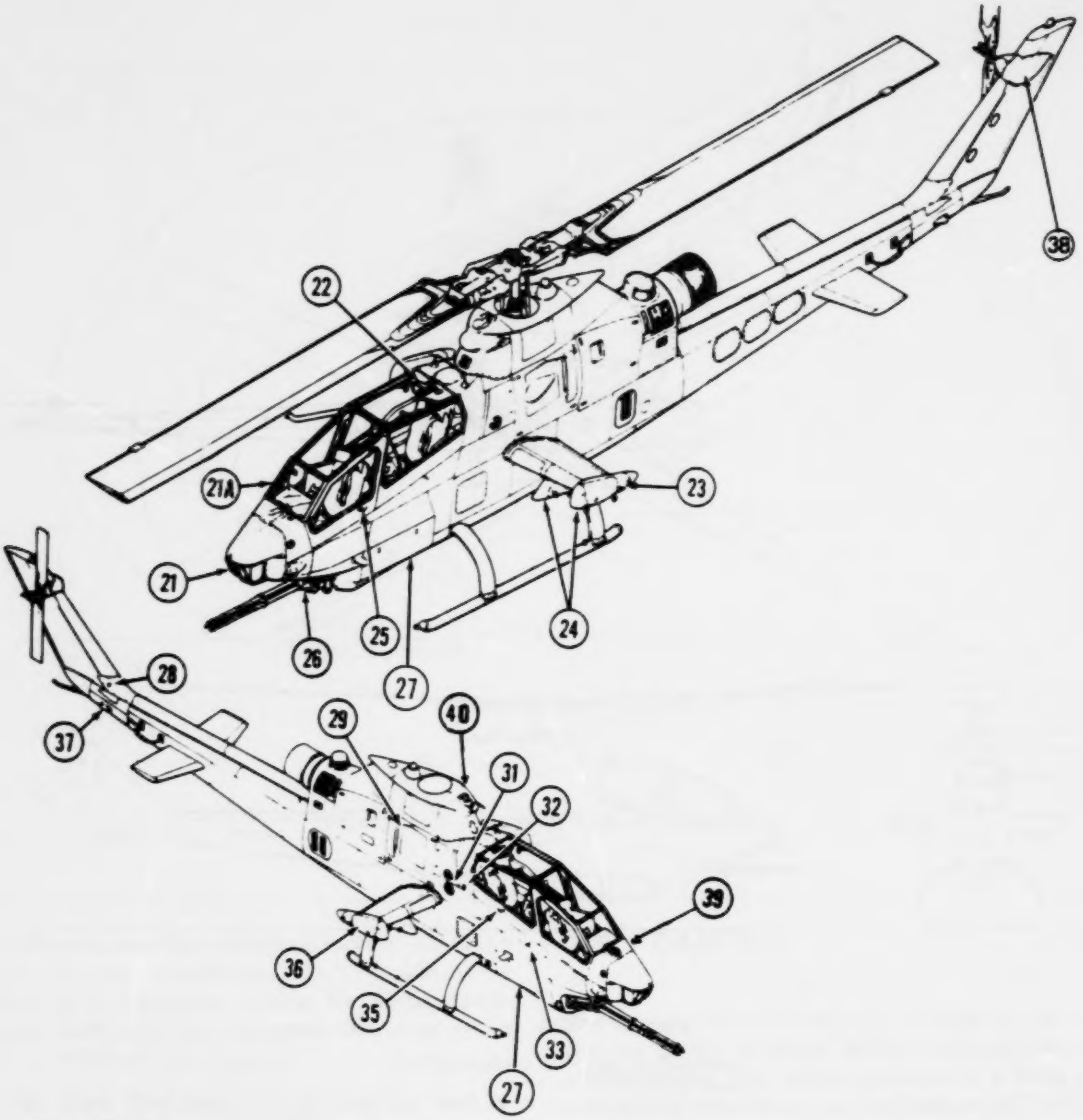
2-7. LANDING GEAR.

a. Main Landing Gear. The main landing gear consists of two aluminum lateral mounted arched


1
2
2A
3
4
5
5A
BOTTOM VIEW
6
7
8
9
10
10A
11
20C
13
20C
12
20C
14
15
20C
20A
20
19
18
16
20C
20B
17

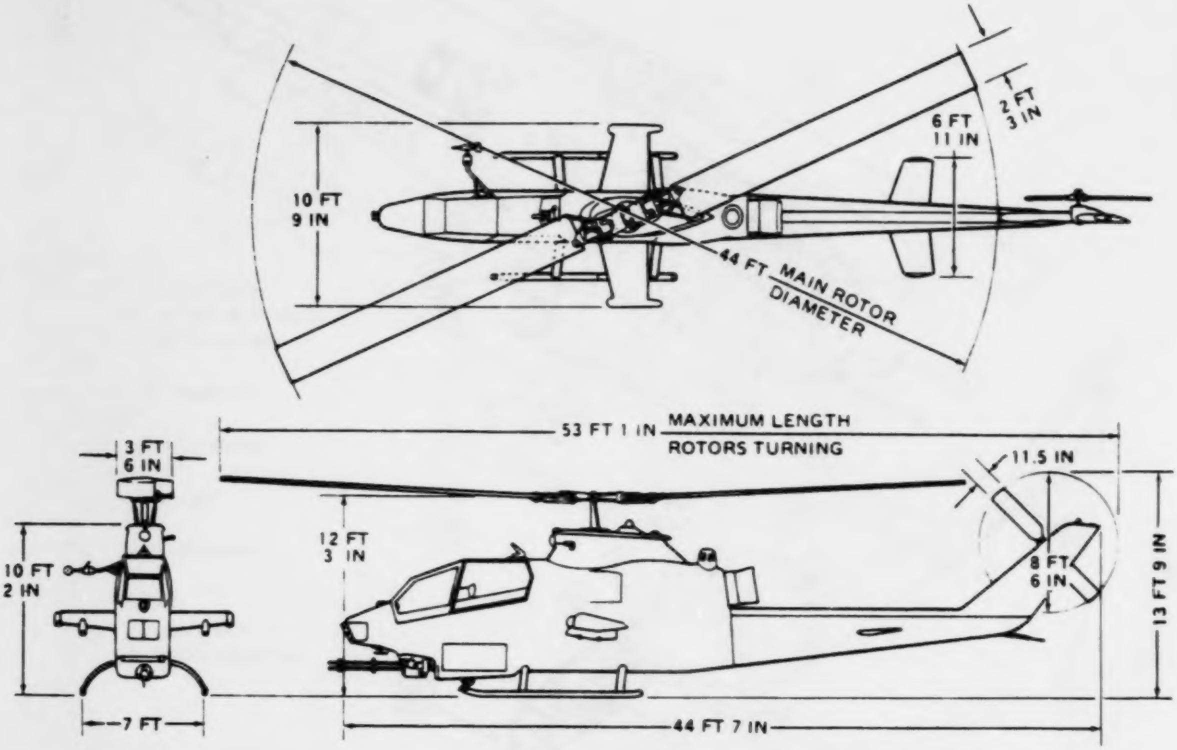
1. Turret
2. Searchlight
2A. Lower cutter assembly
3. Forward fuel cell drain door
4. Aft fuel cell drain door
5. Vent
5A. Chin cutter assembly
6. Tail rotor
7. Synchronized elevator
8. IR jammer
9. Anticollision light
10. Pitot tube
10A. Upper cutter assembly
11. Canopy
12. Pilot door
13. Battery compartment
14. Main rotor blades and hub
15. ADS
16. TSU
17. Skid
18. Transmission compartment
19. Engine compartment
20. GPU receptacle
20A. ALT Receiver
20B. Skid landing light
20C. NVG position lights

Figure 2-1. General Arrangement (Typical)(Sheet 1 of 2)



21. Deflector
21A. Channel
22. Upper cutter assembly
23. Left wing position light (red)
24. Pylons
25. Gunner door latch
26. Turret
27. Searchlight
28. 42 Degree gearbox oil sight glass
29. Engine air inlet — right: (left opposite)
30. Deleted
31. Fuel filler cap
32. Ground receptacle
33. Right static port (left opposite)
34. Deleted
35. Pilot door latch
36. Right wing position light (green)
37. Right tail position light (white) (left opposite)
38. 90 Degree gearbox oil sight glass
39. Countermeasures set, receive ant.
40. Countermeasures set, transmit ant.

Figure 2-1. General Arrangement (Typical)(Sheet 2 of 2)


2 FT
3 IN
6 FT
11 IN
10 FT
9 IN
44 FT MAIN ROTOR
DIAMETER
53 FT 1 IN MAXIMUM LENGTH
ROTORS TURNING
3 FT
6 IN
11.5 IN
10 FT
2 IN
12 FT
3 IN
8 FT
6 IN
13 FT 9 IN
7 FT
44 FT 7 IN

NOTE

DIMENSIONS ARE FOR UNDEFLECTED SKID GEAR.

Figure 2-2. Principal Dimensions (Typical)

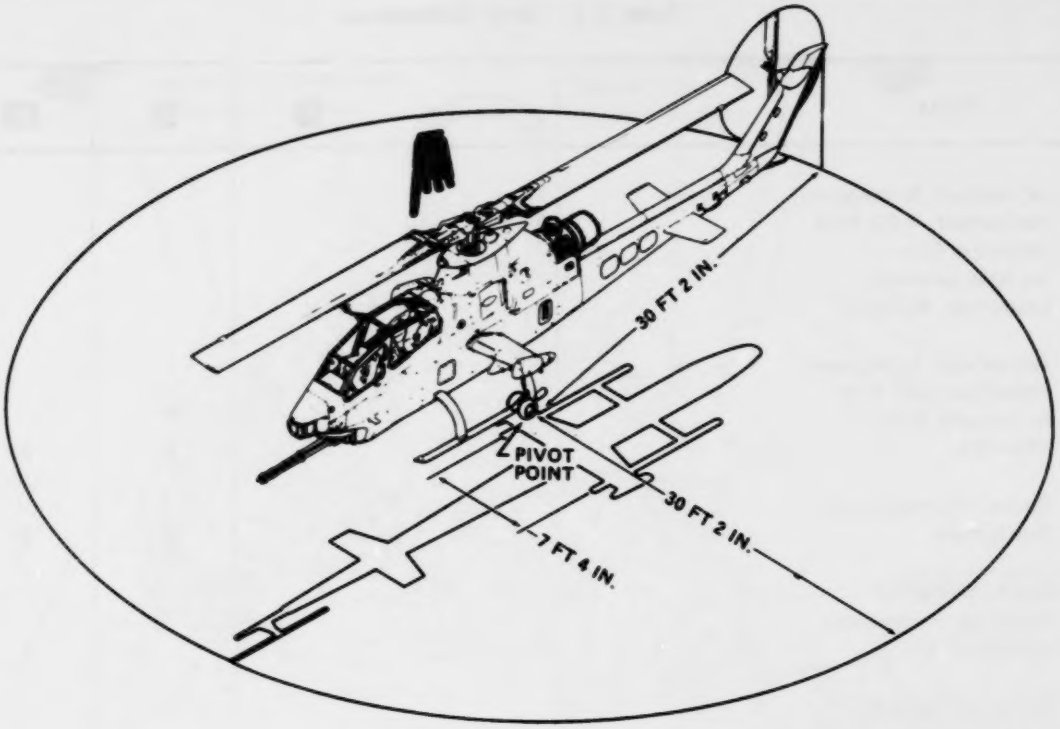


Figure 2-3. Turning Radius (Typical)

crosstubes and two aluminum longitudinal skid tubes attached to the crosstubes. Each crosstube is enclosed in a fiberglass fairing for aerodynamic purposes. Each skid tube has a steel skid shoe on the bottom to minimize skid wear.

b. **Tail Skid.** The steel tubular type tail skid is installed on the aft end of the tailboom to protect the tail rotor blades during tail-low landing.

2-8. INSTRUMENTS AND CONTROLS.

a. **Pilot Instrument Panel.** Figure 2-6 shows the locations of instruments, switches, panels, and decals in the pilot instrument panel.

b. **Gunner Instrument Panel.** Figure 2-7 shows the locations of instruments, switches, panels, and decals in the gunner instrument panel.

c. **Other Instruments and Controls.** These items are shown in the chapter/section which describes their related systems.

2-9. CANOPY.

The canopy is the transparent panels on the upper portion of the fuselage which encloses the crew compartment. The canopy consists of a three piece windshield extending from the nose of the helicopter (over the gunner and pilot heads) to the pylon, the gunner door and pilot window on the left side, and the gunner window and pilot door on the right side. The canopy removal system is used to remove the pilot and gunner windows and doors during emergencies. The system is covered in Chapter 2, Section II.

2-10. PERSONNEL DOORS.

Two access doors are hinged on top and swing outward and up to provide access. The doors have gas operated struts that will hold the doors in the full open position with a force of approximately 70 pounds.

Table 2-1. Main Differences

ITEM	P	E	M
Armament Subsystem, Helicopter, 7.62 MM Machine Gun — 40 MM Grenade Launcher, M28A3	X		
Armament Subsystem, Helicopter; 20 MM Automatic Gun: XM97E1		X	X
Rocket Management Subsystem		X	X
Sight Helicopter Head-Up Subsystem: XM76			X
Fire and Flight Air Data Subsystem, Helicopter Armament: XM143			X
Fire Control Computer			X
Airborne Laser Tracker			X
Receiver-Transmitter, Radar RT-1156/APX 100(V)			X
Transponder Set AN/APX-72	X	X	
IR Jammer AN/ ALQ-144 System			X
Navigation Set, Airborne AN/APN-128			X

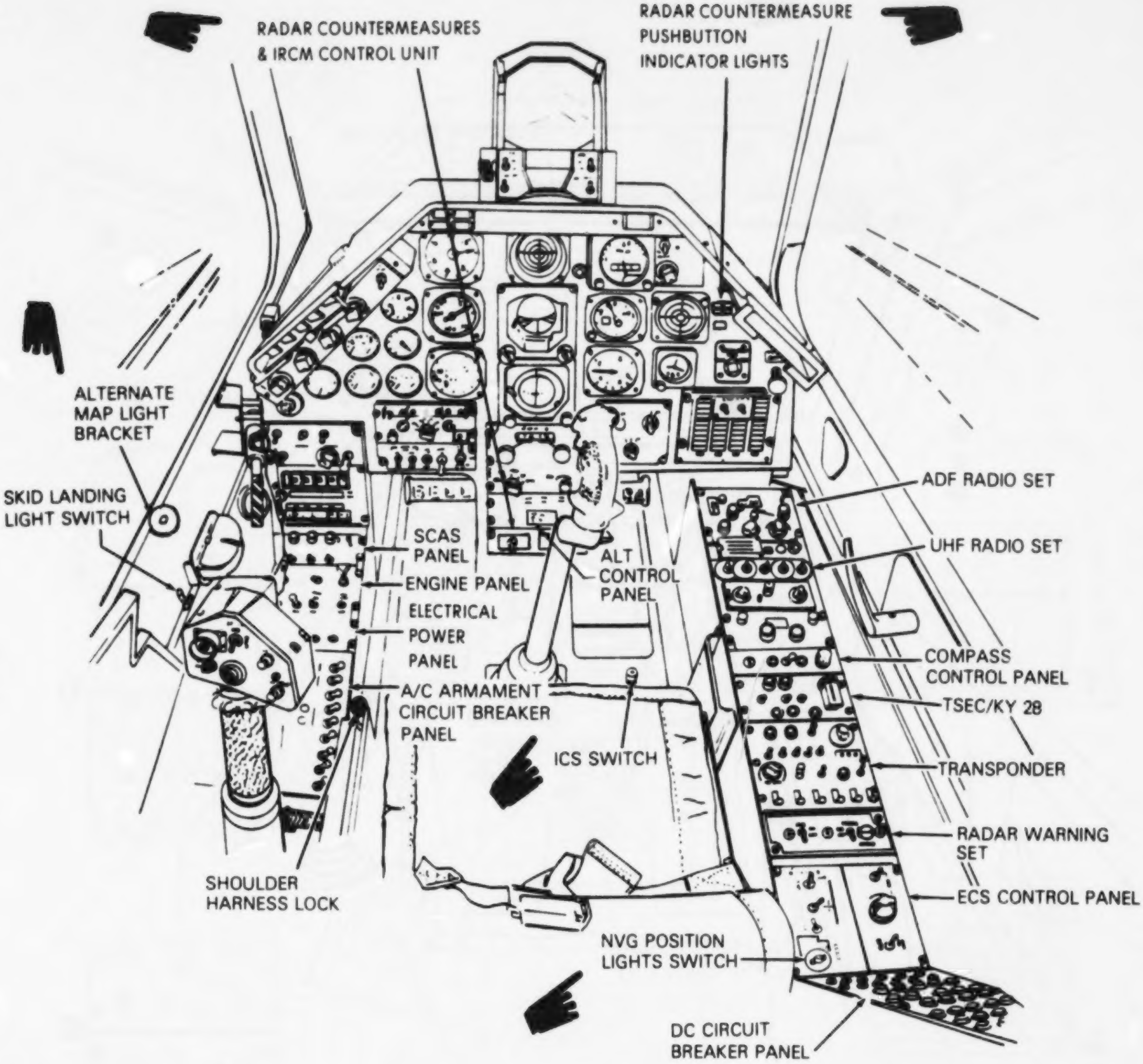
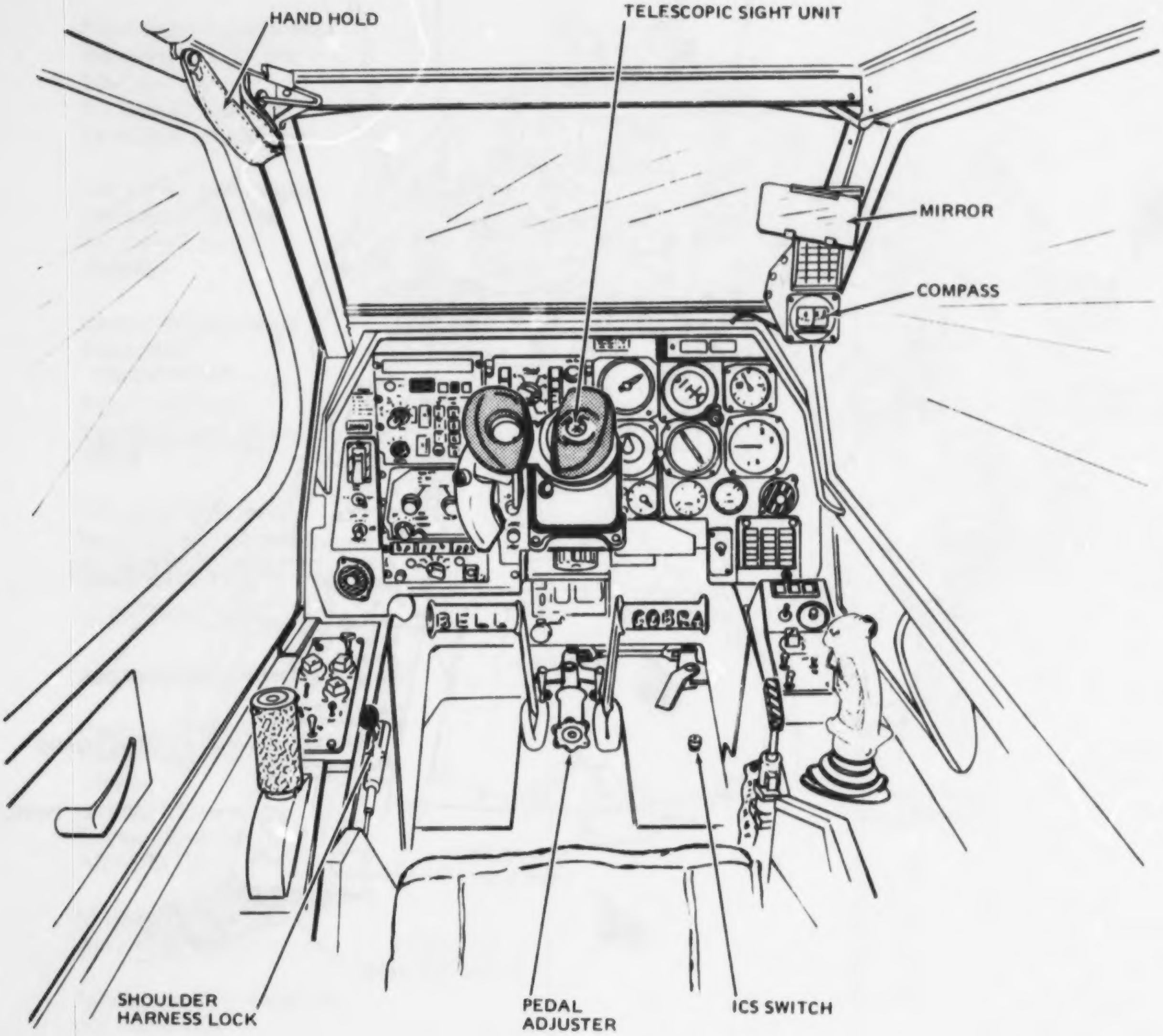
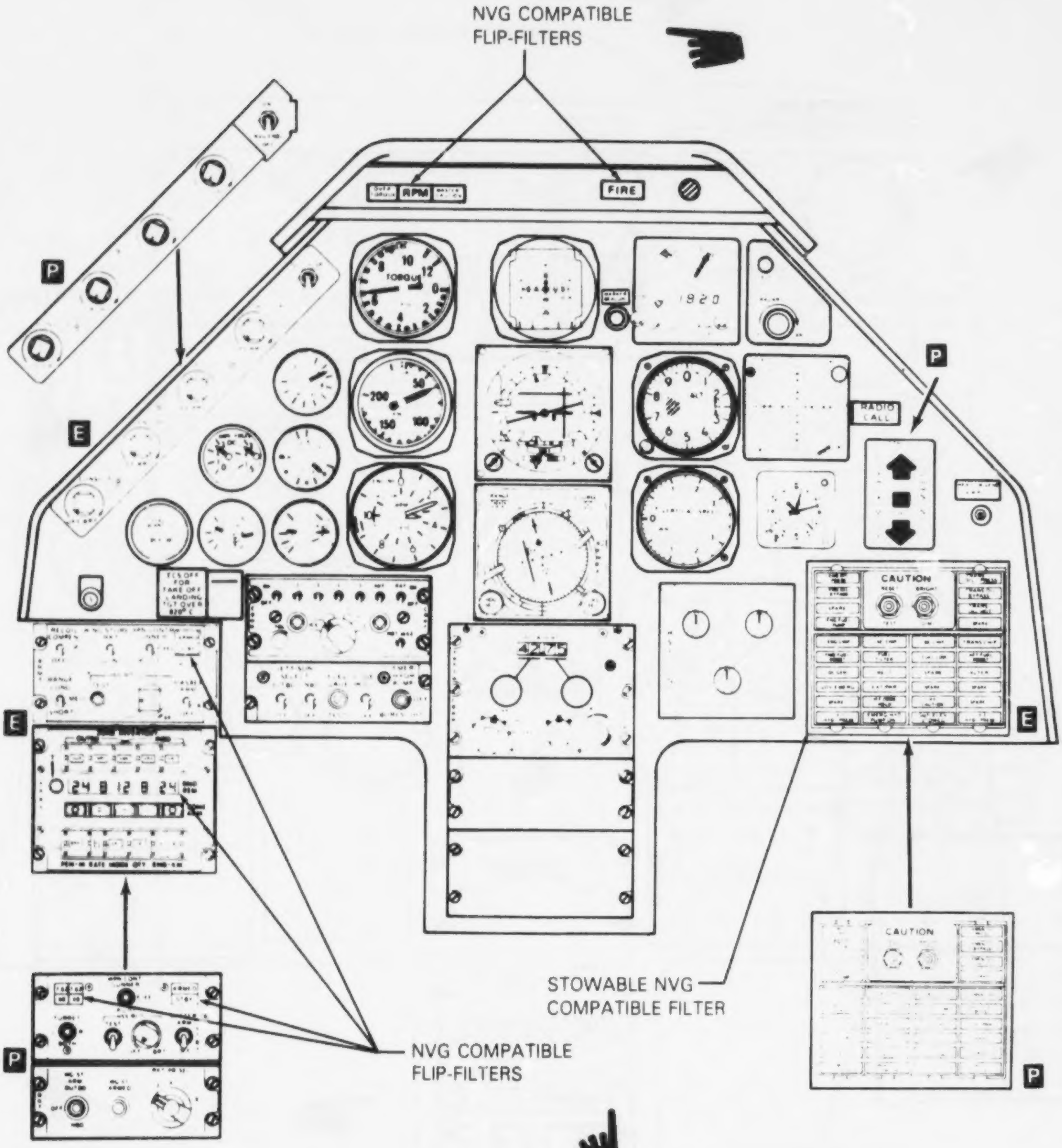

RADAR COUNTERMEASURES
& IRCM CONTROL UNIT
RADAR COUNTERMEASURE
PUSHBUTTON
INDICATOR LIGHTS
ALTERNATE
MAP LIGHT
BRACKET
SKID LANDING
LIGHT SWITCH
SCAS
PANEL
ENGINE PANEL
ELECTRICAL
POWER
PANEL
ALT
CONTROL
PANEL
A/C ARMAMENT
CIRCUIT BREAKER
PANEL
ICS SWITCH
SHOULDER
HARNESS LOCK
ADF RADIO SET
UHF RADIO SET
COMPASS
CONTROL PANEL
TSEC/KY 28
TRANSPONDER
RADAR WARNING
SET
ECS CONTROL PANEL
NVG POSITION
LIGHTS SWITCH
DC CIRCUIT
BREAKER PANEL

Figure 2-4. Pilot Station Diagram (Typical)


HAND HOLD
TELESCOPIC SIGHT UNIT
MIRROR
COMPASS
BELL
COBRA
SHOULDER HARNESS LOCK
PEDAL ADJUSTER
ICS SWITCH

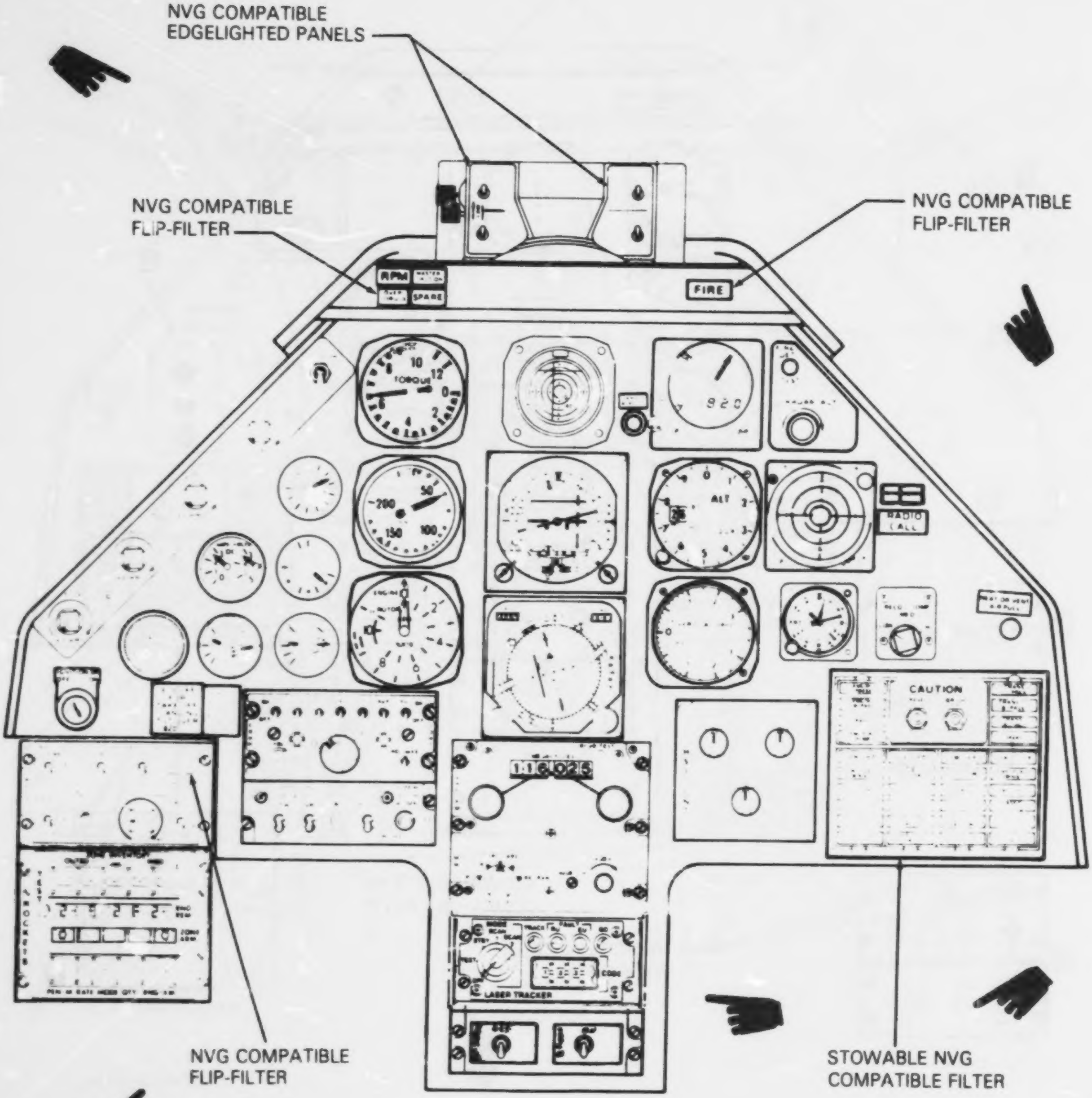
209075-422A

Figure 2-5. Gunner Station Diagram (Typical)


NVG COMPATIBLE
FLIP-FILTERS
RPM
FIRE
TORQUE
RADIO CALL
CAUTION
4275
P
E
P
E
E
P
NVG COMPATIBLE
FLIP-FILTERS
STOWABLE NVG
COMPATIBLE FILTER
P

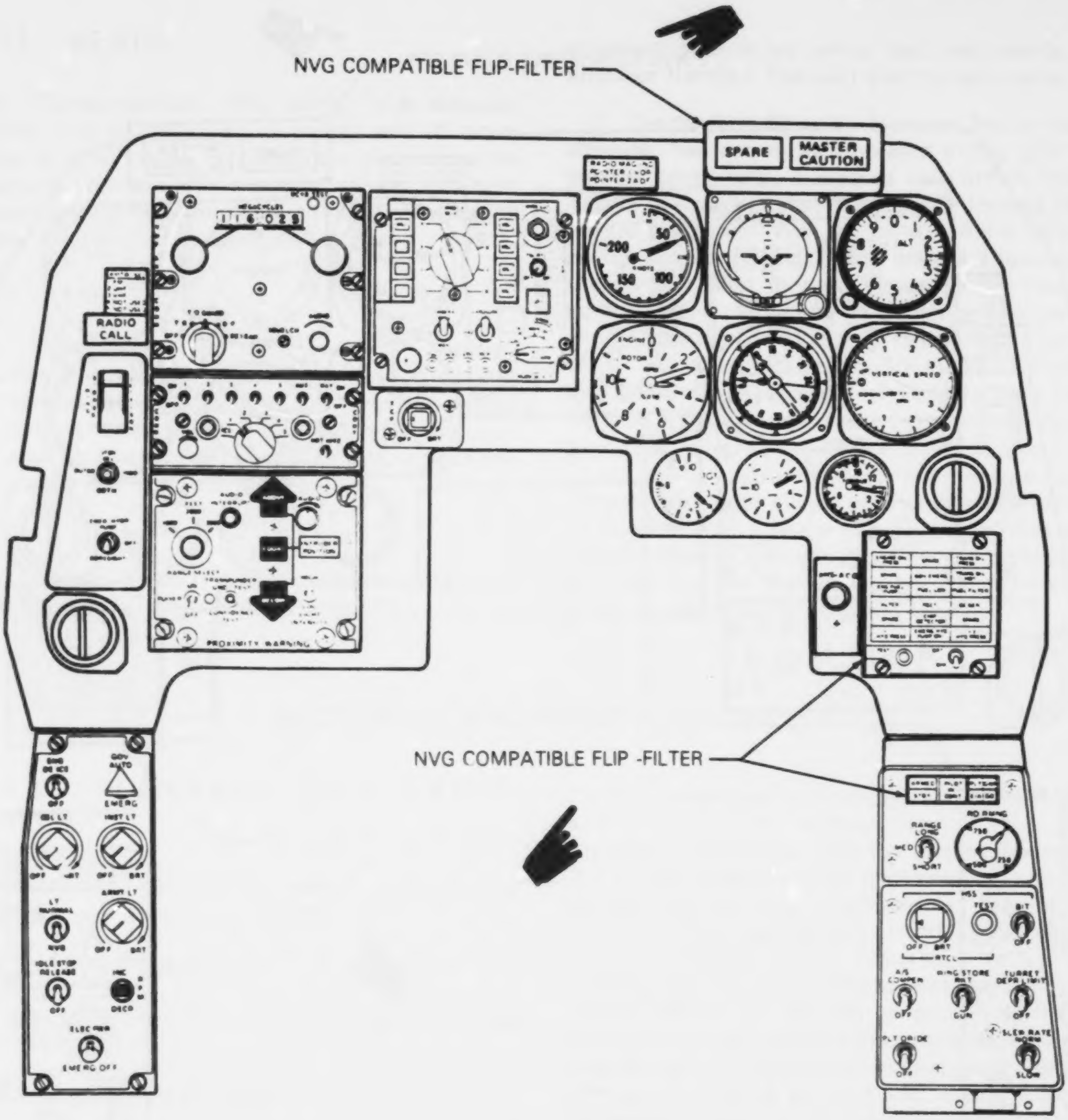
209075-303L

P E Figure 2-6. Pilot Instrument and Control Panel (Sheet 1 of 2)


NVG COMPATIBLE EDGELIGHTED PANELS
NVG COMPATIBLE FLIP-FILTER
NVG COMPATIBLE FLIP-FILTER
RPM
SPARE
FIRE
TORQUE
ALT
RADIO CALL
CAUTION
LASER TRACKER
NVG COMPATIBLE FLIP-FILTER
STOWABLE NVG COMPATIBLE FILTER

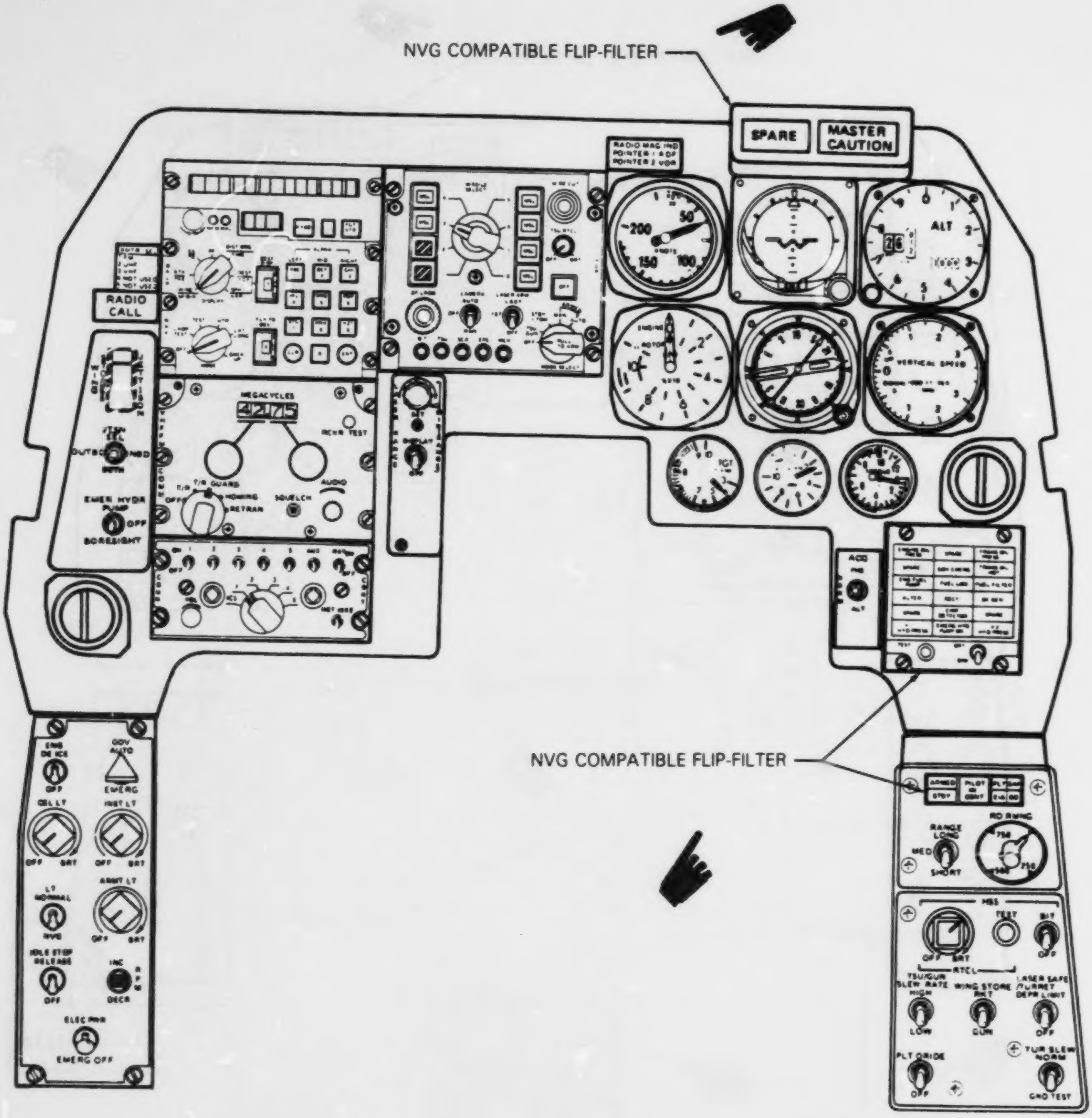
209075-429A

M Figure 2-6. Pilot Instrument and Control Panel (Sheet 2 of 2)


NVG COMPATIBLE FLIP-FILTER
SPARE
MASTER CAUTION
RADIO CALL
ALT
VERTICAL SPEED
PROXIMITY WARNING
NVG COMPATIBLE FLIP -FILTER
GOV AUTO
EMERG
OFF
BRT
ELEC PWR
EMERG OFF
RANGE
LONG
MED
SHORT
HSS
TEST
BIT
A/S COMPEN
WING STORE RKT
GUN
TURRET DEPR LIMIT
SLEW RATE NORM
SLOW

209075-387E

P E Figure 2-7. Gunner Instrument and Control Panel (Typical)(Sheet 1 of 2)


NVG COMPATIBLE FLIP-FILTER

NVG COMPATIBLE FLIP-FILTER

SPARE
MASTER CAUTION
RADIO MAG IND POINTER 1 ADF POINTER 2 VOR
RADIO CALL
MEGACYCLES
RCVR TEST
T/R GUARD
HOMING
RETRAN
SQUELCH
AUDIO
OUTBD
BOTH
EMER HYDR PUMP
OFF
BORESIGHT
KNOTS
ALT
ENGINE
ROTOR
VERTICAL SPEED
TGT
ACQ
ALT
ENG DE ICE
GOV AUTO
EMERG
CSL LT
INST LT
OFF
BRT
LT NORMAL
NVG
ARMT LT
IDLE STOP RELEASE
INC
RPM
DECR
ELEC PWR
EMERG OFF
RANGE
LONG
MED
SHORT
RD RMNG
MSS
TEST
BIT
RTCL
TSU/GUN SLEW RATE
HIGH
LOW
WING STORE
RKT
GUN
LASER SAFE /TURRET DEPR LIMIT
TUR SLEW
NORM
GND TEST
PLT ORIDE

209075-432C

M Figure 2-7. Gunner Instrument and Control Panel (Sheet 2 of 2)

2-11. SEATS.

a. **Construction.** The seats, side-shoulder panels, and head protective panels are of armor material which provides protection. Both seats are equipped with contoured seat cushions and back supports made of foam and open mesh for vibration attenuation and crew comfort.

b. **Pilot Seat.** The pilot seat is vertically adjustable nonreclining type. The vertical adjustment is reclined at 15 degrees. The vertical height adjustment handle (figure 2-8) is under the left side of the seat. The seat is equipped with a lap safety belt and inertia reel shoulder harness.

c. **Gunner Seat.** The gunner seat is a fixed seat (non-adjustable and nonreclining). The seat is equipped with a lap safety belt and inertia reel shoulder harness. The seat also has arm rests.

d. **Inertia Reel Shoulder Harness.** An inertia reel shoulder harness is incorporated in the pilot and gunner seats with a manual lock-unlock control handle (figure 2-8). The handles are located to left front of each seat. With the control in the unlocked position, the reel cable will extend allowing the occupant to lean forward; however, the reel will automatically lock when helicopter encounters an impact force of two to three "g" deceleration. Locking of the reel can be accomplished from any position and the reel will automatically take up the slack in the harness. To release the lock, it is necessary to lean back slightly to release tension on the lock and then unlock position. It is possible to have pressure against the seat back whereby no additional movement can be accomplished and the lock cannot be released. If this condition occurs, it will be necessary to loosen shoulder harness. Manual locking of the reel should be accomplished for emergency landings.

SECTION II. EMERGENCY EQUIPMENT

2-12. PORTABLE FIRE EXTINGUISHER.

A portable hand-operated fire extinguisher is located forward of the gunner seat (figure 9-1).

2-13. FIRST AID KIT.

An aeronautical type first aid kit is located behind the pilot seat (figure 9-1).

2-14. SURVIVAL KIT.

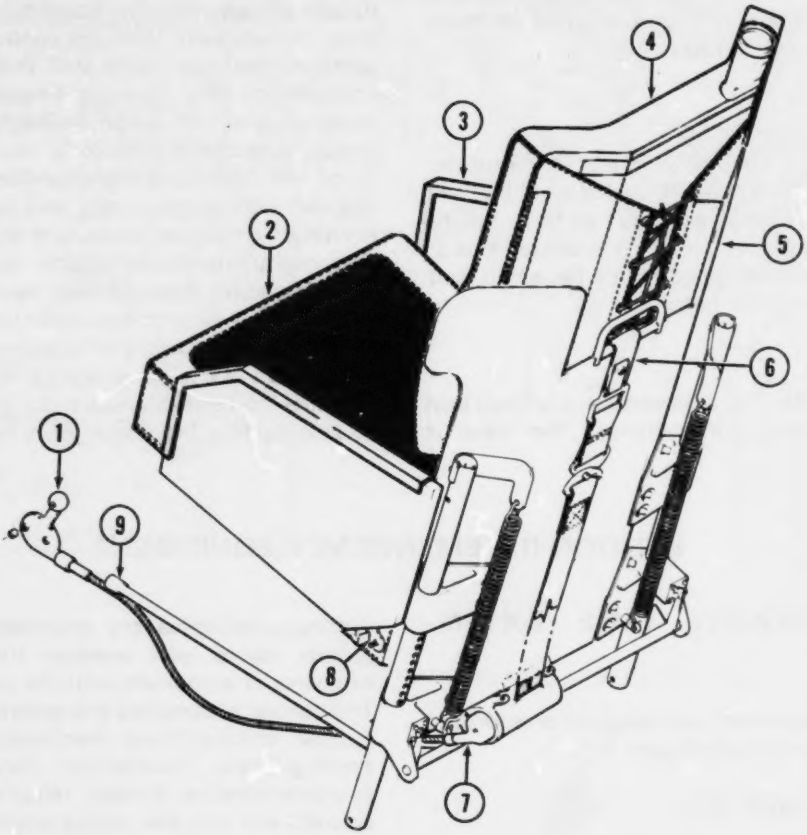
Provisions only.

2-15. CANOPY REMOVAL SYSTEM.

WARNING

Debris may be expelled 50 feet outward when system is actuated.

Cutting assemblies are mounted in the pilot and gunner doors and window frames. The linear explosive is contained with the cutting assemblies. The cutting assemblies are controlled by the pilot or gunner arming/firing mechanisms. Rotating the arming/firing mechanism handle 90 degrees counterclockwise (torque required 6 to 12 inch-pounds) will arm the cutting assemblies. Pulling the handle (20 to 35 pounds tension) will fire the percussion primer causing the cutting assemblies to be detonated. The explosive force will be outward and remove two windows and two doors from the helicopter simultaneously. If handle has been rotated but not pulled, the handle can be rotated clockwise and the safety pin installed. DA Form 2408-13 entry required. Refer to Chapter 9 for emergency procedure and figure 9-1 for equipment location.



1. **Shoulder harness lock**
2. **Seat cushion**
3. **Side armor panels**
4. **Seat back cushion**
5. **Seat assembly**
6. **Shoulder harness**
7. **Inertia reel**
8. **Seat lap belt**
9. **Height adjustment handle**

209070-214A

Figure 2-8. Pilot Seat Installation (Typical)

SECTION III. ENGINE AND RELATED SYSTEMS

2-16. ENGINE.

The helicopter is equipped with a T53-L-703 engine (figure 2-9). The engine, in this installation, is derated by limitation of the helicopter transmission to 100% torque for 30 minutes and 88% torque for continuous operation at 100% rpm. The engine compartment is cooled by ram and ambient air.

2-17. ENGINE PROTECTION.

Armor material is located on the left and right engine compartment doors to provide armor protection for the engine compressor, fuel control, oil filter, and fuel filter.

2-18. AIR INDUCTION SYSTEM.

Ambient air enters the transmission compartment door air inlet, then is routed through the foreign object damage (FOD) screen and the particle separator to the engine air inlet.

a. **Foreign Object Damage (FOD) Screen.** The FOD screen is mounted around the particle separator on the forward end of the engine in the transmission compartment. The purpose of the screen is to prevent debris from entering the particle separator.

b. **Particle Separator.** The self-purging particle separator is located over the engine air inlet in the transmission compartment. The purpose of the separator is to remove particles from the engine inlet air and automatically eject them overboard.

2-19. ENGINE INLET ANTI-ICING/DEICING SYSTEM.

WARNING

The system will not deice or prevent icing of the FOD screen or particle separator. A power loss will occur if the formation of ice in the FOD screen or particle separator obstructs the flow of ambient air to the engine.

a. **Description.** The system prevents ice from forming in the engine air inlet. The system consists of a hot air solenoid valve on the engine, controlled by the pilot or gunner ENG DEICE switch (figures 2-10 and 2-11), powered by the dc essential bus, and protected by the ENG DEICE circuit breaker.

b. **Operation.** If ice accumulation is suspected, the pilot or gunner ENG DEICE switch is placed in the DEICE position. This action causes the hot air solenoid valve to route engine bleed air to the engine air inlet. A rise in the turbine gas temperature (TGT) will occur when the pilot or gunner ENG DEICE switch is in the DEICE position. De-ice operation will become continuous if the hot air solenoid valve (ENG DEICE) circuit fails or if ENG DEICE circuit breaker is out (extended).

2-20. ENGINE FUEL CONTROL SYSTEM.

a. **Engine Mounted Component.** The fuel control assembly is mounted on the left side of the engine. This unit is controlled by the pilot or gunner throttle and GOV switch. The assembly consists of a metering section, a computer section, and an overspeed governor. The metering section pumps fuel to the engine. The computer section determines the rate of fuel delivery. The overspeed governor maintains a constant N2 rpm.

b. **Crew Controls.**

(1) **Throttles.** Setting the pilot or gunner throttle to the full open position allows the engine to operate up to full power available. Rotating the throttle back toward idle position decreases the allowable N2 and power which, if below that demanded by collective pitch input, results in proportional N2 speed decrease. Rotating the throttle past the engine idle stop to the fully closed position shuts off fuel flow. A solenoid operated idle stop is incorporated to prevent inadvertent throttle closure. The idle stop is controlled by the pilot IDLE STOP REL switch (figure 2-14) or the gunner IDLE STOP RELEASE switch (figure 2-11). The engine idle stop release circuit is powered by the dc essential bus and protected by the IDLE STOP SOL circuit breaker. Friction can be induced into both throttles by rotating the pilot throttle friction (figure 2-14) counterclockwise.

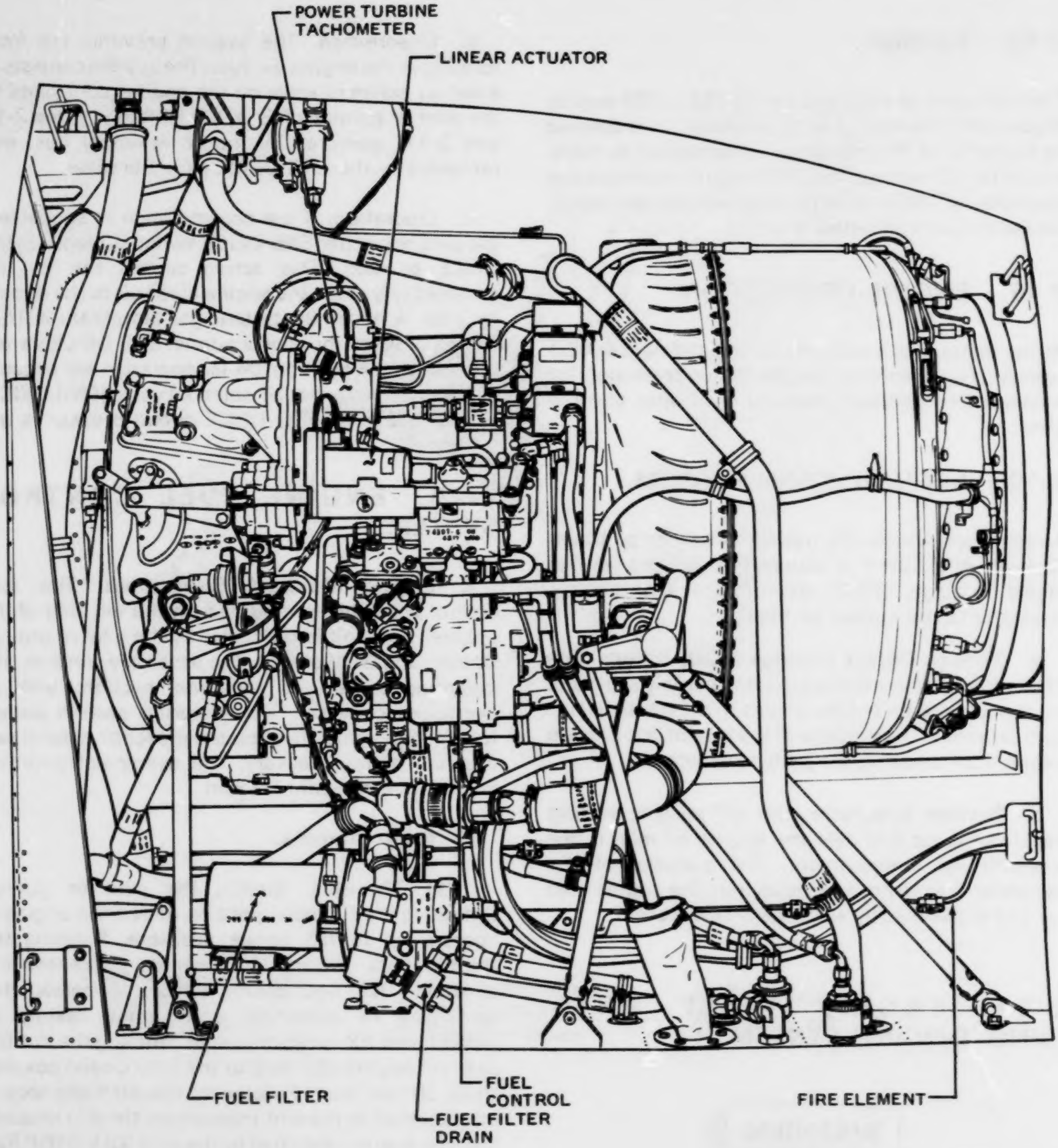

POWER TURBINE TACHOMETER
LINEAR ACTUATOR
FUEL FILTER
FUEL CONTROL
FUEL FILTER DRAIN
FIRE ELEMENT
209060-128-1

Figure 2-9. Power Plant Installation (Sheet 1 of 2)

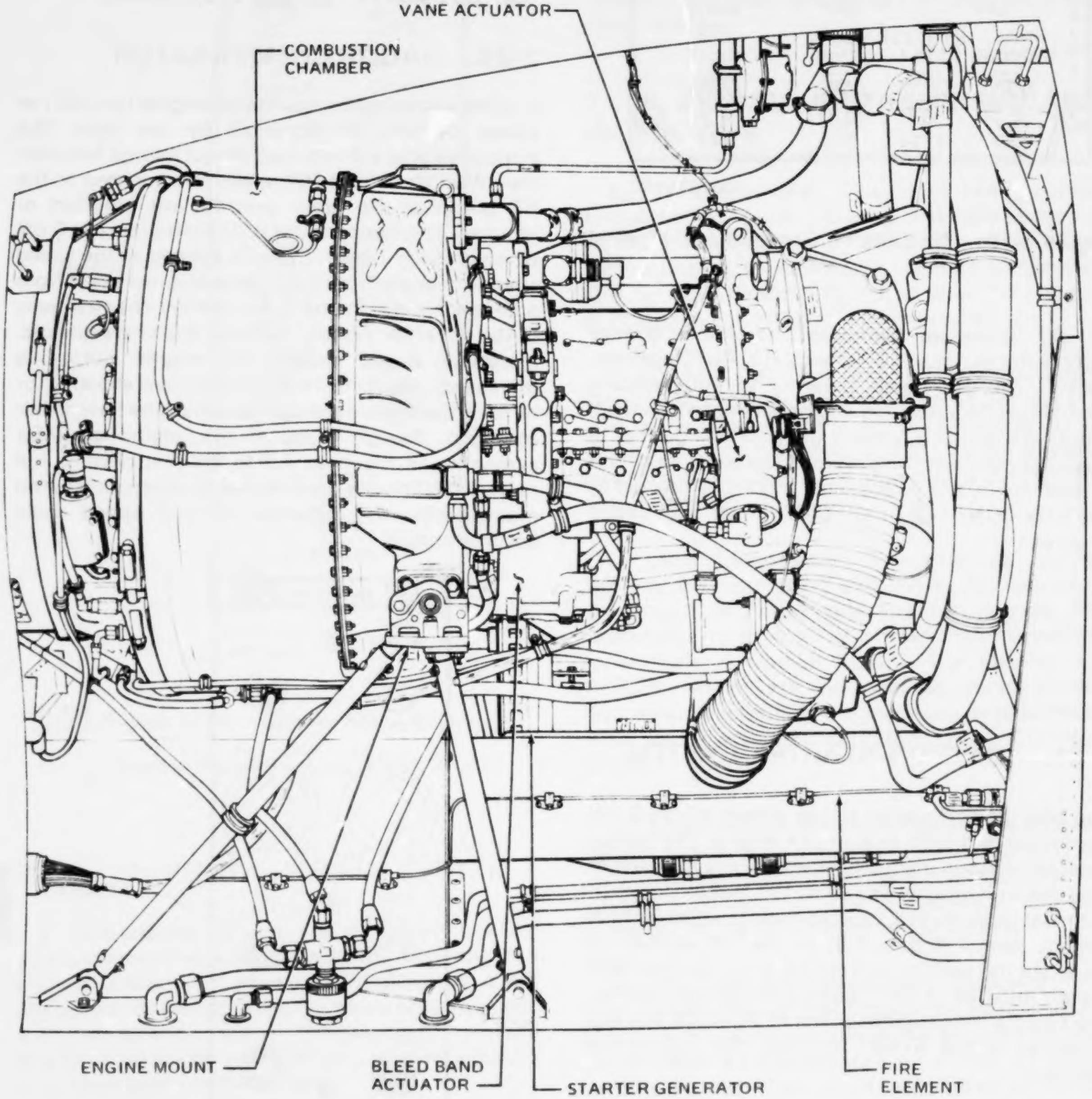

INLET GUIDE
VANE ACTUATOR
COMBUSTION
CHAMBER
ENGINE MOUNT
BLEED BAND
ACTUATOR
STARTER GENERATOR
FIRE
ELEMENT
209060-128-2

Figure 2-9. Power Plant Installation (Sheet 2 of 2)

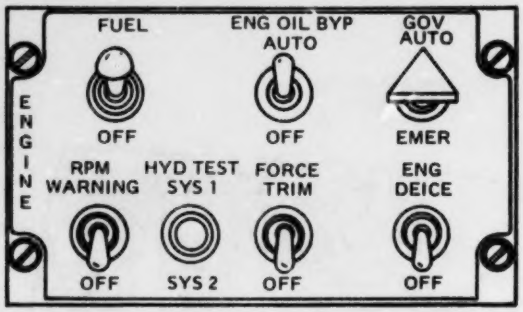

FUEL
ENG OIL BYP
AUTO
GOV
AUTO
ENGINE
OFF
OFF
EMER
RPM
WARNING
HYD TEST
SYS 1
FORCE
TRIM
ENG
DEICE
OFF
SYS 2
OFF
OFF
209075-6C

Figure 2-10. Pilot Engine Control Panel (Typical)

(2) **Governor Switches.** The pilot or gunner GOV switches (figures 2-10 and 2-11) AUTO position, permits the overspeed governor to automatically control fuel metering and engine speeds (N1 and N2). The EMER position permits the pilot and gunner to manually control the engine rpm. The governor circuit is powered by the dc essential bus and protected by the GOV CONT P GOV CONTR E M circuit breaker.

2-21. IGNITION-STARTER SYSTEM.

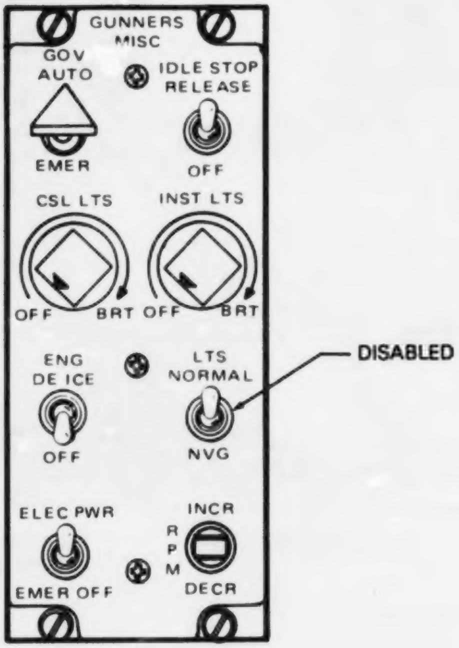
The pilot ignition-starter trigger switch (figure 2-14) is pressed and held to start the engine. The switch must be released manually when the engine starts or the time limit expires. The pilot FUEL switch (figure 2-10) must be in the FUEL position and the pilot ignition keylock switch (figure 2-6) in the ON position to complete the ignition and start fuel circuit. The GEN switch must be in OFF position for normal starting. The circuits are powered by the dc essential bus and protected by the START RLY and IGN SOL circuit breakers.

2-22. RPM INCREASE-DECREASE (INCR-DECR) SWITCHES.

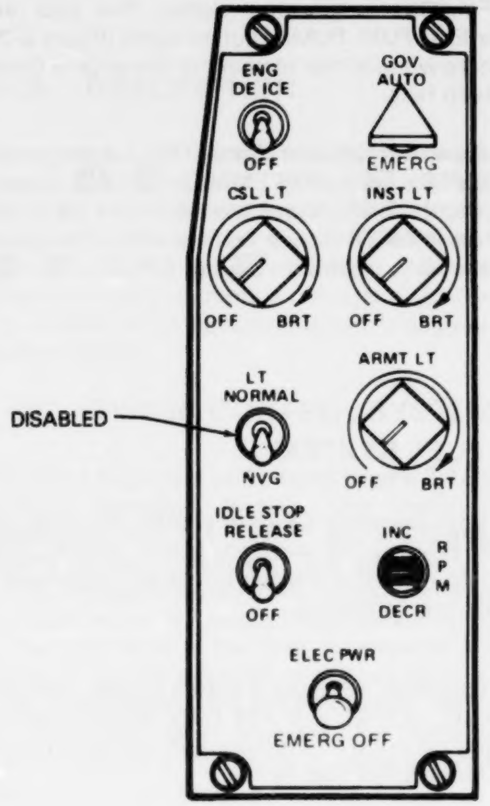
The pilot RPM INCR-DECR or gunner INCR-DECR P INC-DECR E M switch (figures 2-10 and 2-11) is a three-position, momentary-type switch located in the pilot collective switch box and gunner miscellaneous control panel. The switch is held forward to increase and aft to decrease the power turbine speed. The circuit is powered by the dc essential bus and protected by the GOV CONT P GOV CONTR E M circuit breaker.

2-23. DROOP COMPENSATOR.

A droop compensator maintains engine rpm (N2) as power demand is increased by the pilot. The compensator is a direct mechanical linkage between the collective stick and the speed selector lever on the N2 governor. No crew controls are provided or required. The compensator will hold N2 rpm to ±0.6% when properly rigged. Droop is defined as the speed change in engine rpm (N2) as power is increased from a no-load condition and is an inherent characteristic of the governor system. Without this characteristic, instability would develop as engine output is increased, resulting in N1 speed overshooting or hunting the value necessary to satisfy the new power condition. Design droop of the engine governor system is as much as 4.5 to 6% (flat pitch to full power). If N2 power were allowed to droop, other than momentarily, the reduction in rotor speed could become critical.


GUNNERS
MISC
GOV
AUTO
IDLE STOP
RELEASE
EMER
OFF
CSL LTS
INST LTS
OFF
BRT
OFF
BRT
ENG
DE ICE
LTS
NORMAL
DISABLED
OFF
NVG
ELEC PWR
INCR
RPM
EMER OFF
DECR
209075-5D

P Figure 2-11. Gunner Miscellaneous Control Panel (Sheet 1 of 2)



E **M** **Figure 2-11. Gunner Miscellaneous Control Panel (Typical) (Sheet 2 of 2)**

2-24. ENGINE OIL SUPPLY SYSTEM.

a. **Description.** The engine oil system is a dry sump, pressure type, and completely automatic. The oil tank is located in the upper pylon fairing. It will self-seal a 30 caliber projectile hole and is equipped with deaeration provisions. Oil is gravity fed from tank to engine driven oil pump which provides pressure and scavenging for the system.

b. **Cooling.** Engine oil cooling is accomplished by an oil cooler and a bleed air driven turbine fan. The engine and transmission oil coolers use the same fan.

c. **Switching Action.** The pilot ENG OIL BYP switch (figure 2-10) AUTO position permits the oil to automatically bypass the oil cooler when the oil tank is approximately 3.8 quarts low. The OFF position deactivates the automatic bypass feature causing the oil to pass through the oil cooler regardless of the oil tank level. The switch circuit is powered by the dc essential bus and protected by the FUEL OIL VALVE circuit breaker.

2-25. ENGINE INSTRUMENTS AND INDICATORS.

a. **Torquemeters.** The pilot and gunner torquemeters (figures 2-6 and 2-7) display percent of torque imposed upon the engine output shaft. Each torquemeter is powered by a separate transmitter. The circuit is powered by the dc essential bus and protected by the TRQ IND circuit breaker.

b. **Turbine Gas Temperature (TGT) Indicators.** The pilot and gunner indicators (figures 2-6 and 2-7) display the temperature in degrees celsius of the air in the first stage N2 nozzle. The circuits are powered by the dc essential bus and protected by the TGT IND circuit breaker.

c. **Dual Tachometers.** The pilot and gunner tachometers (figures 2-6 and 2-7) display the rpm of the engine and main rotor speed in percent. The tachometer outer scale is marked ENGINE and the inner scale is marked ROTOR. The ENGINE and ROTOR needles are synchronized during normal helicopter operation. The circuit is powered by the dc essential bus and protected by the DUAL TACH circuit breaker.

d. **Gas Producer N1 Tachometers.** The pilot and gunner tachometers (figures 2-6 and 2-7) display the rpm of the gas producer turbine speed in percent. The circuit is powered by the dc essential bus and protected by the GAS PROD circuit breaker.

e. **Oil Pressure/Temperature Indicator.** The pilot indicator (figure 2-6) displays the psi pressure of the oil at the pressure side of the oil pump and the temperature as degrees celsius of the oil at the engine oil inlet. The circuit is powered by the dc essential bus and protected by the TEMP IND ENG XMSN circuit breaker.

f. **Oil Pressure Caution Light.** The pilot ENG OIL PRESS and gunner ENGINE OIL PRESS (figure 2-23) will illuminate when the engine oil pressure is below safe limits.

g. **Oil Bypass Caution Light.** The pilot ENG OIL BYPASS caution light (figure 2-23) illuminates when oil tank level is approximately 3.8 quarts low.

h. **Engine Oil Chip Detector Caution Light.** The caution lights, ENG CHIP in pilot caution panel and CHIP DETECTOR in gunner caution panel, illuminate when sufficient metal chips to complete the electrical circuit are collected from the engine oil.

i. **Fuel Pump Caution Lights.** The pilot and gunner ENG FUEL PUMP caution lights (figure 2-23) illuminate when either element of the engine driven fuel pump fails.

j. **Governor Caution Lights.** The pilot and gunner GOV EMER P , GOV EMERG E M caution lights (figure 2-23) illuminate when the pilot GOV switch is in EMER (figure 2-10) or when the gunner GOV switch is in EMER P or EMERG E M (figure 2-11).

SECTION IV. HELICOPTER FUEL SYSTEM

2-26. FUEL SUPPLY SYSTEM.

The helicopter is equipped with a crashworthy fuel system. The system is designed with the potential of containing fuel during a severe, but survivable, crash impact to reduce the possibility of fire. The system has a 50 caliber ballistic protection level. Fuel grades and specifications are included in Section XIV.

2-27. CONTROLS AND INDICATORS.

a. **Fuel Switch.** The pilot FUEL switch (figure 2-10) FUEL position energizes the forward and aft boost pumps, opens the fuel shutoff valve, and completes the ignition and start fuel circuit. The aft fuel boost pump circuit is powered by the dc nonessential bus. The other circuits are powered by the dc essential bus. The circuits are protected by the START RLY, IGN SOL, FUEL/OIL VALVE, FUEL BOOST FWD, and FUEL BOOST AFT circuit breakers.

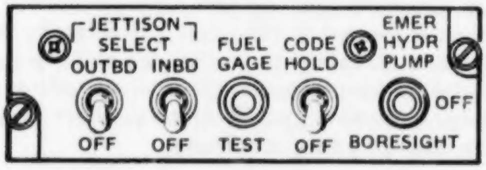
b. **Fuel Quantity Indicator.** The pilot indicator (figure 2-6) displays the pounds of fuel in the fuel cells. The circuit is powered by the ac system and protected by the FUEL QTY circuit breaker.

c. **Fuel Quantity Indicator Test Switch.** The pilot FUEL GAGE TEST switch (figure 2-12) is used to test the fuel quantity indicator operation. Pressing the switch causes the indicator pointer to move from the actual reading to a lesser reading. Releasing the switch will cause the pointer to return to the actual reading. The circuit is powered by the ac system and protected by the FUEL QTY circuit breaker.

d. **Low Quantity Caution Lights.** The pilot and gunner FUEL LOW caution lights (figure 2-23) illuminate when there is approximately 10 percent of the total fuel remaining.

e. **Low Fuel Pressure Caution Lights.** The pilot FWD FUEL BOOST and AFT FUEL BOOST caution lights (figure 2-23) illuminate when the boost pumps in the forward/aft fuel cell fail.

f. **Fuel Filter Caution Lights.** The pilot and gunner FUEL FILTER caution lights (figure 2-23) illuminate when the filter in the fuel supply line becomes partially obstructed.



209075-308

Figure 2-12. Pilot Miscellaneous Control Panel

SECTION V. FLIGHT CONTROLS

2-28. DESCRIPTION.

The flight control system is a positive mechanical type, actuated by cyclic, collective, and tail rotor controls. Complete controls are provided for both pilot and gunner. The gunner controls are slaved to the pilot controls. The system includes a cyclic system, a collective control system, a tail rotor system, a force trim system, and a stability and control augmentation system (SCAS).

2-29. CYCLIC CONTROL SYSTEM.

The pilot and gunner cyclic sticks (figure 2-13) have a built-in operating friction. The cyclic control movements are not mixed, but are transmitted directly to the swashplate. The longitudinal cyclic control linkage is routed from the cyclic stick through the SCAS actuator, the dual boost hydraulic actuator to the right horn of the fixed swashplate ring. The lateral is similarly routed to the left horn. Control "feel" is provided by the force trim units. The fore and aft movement also changes the synchronized elevator (figure 2-1) attitude to assist controllability and lengthen c.g. range.

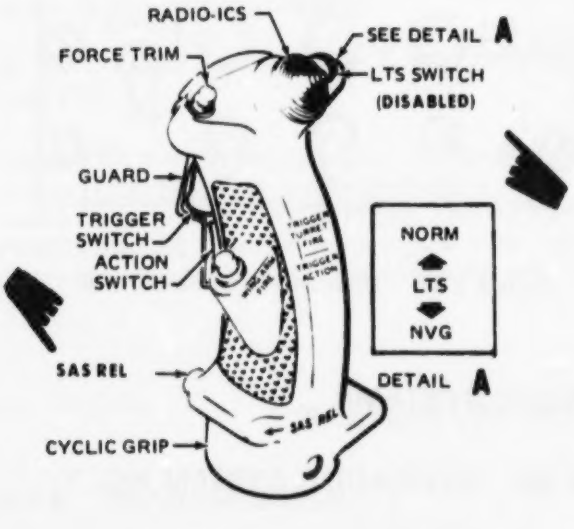


Figure 2-13. Pilot and Gunner Cyclic Control Stick

2-30. COLLECTIVE CONTROL SYSTEM.

The pilot and gunner collective pitch controls (figure 2-14) are located on the left side of the pilot and gunner seats and control vertical mode of flight. Moving the stick up or down changes the angle of attack and lift developed by the main rotor resulting in the ascent or descent of the helicopter. The collective assembly consists of a collective stick, with adjustable friction system (pilot only), twist grip-type throttle with friction adjuster, and switch box assembly (pilot only). The switch box assembly incorporates the ignition starter switch, rpm increase-decrease switch, jettison, searchlight switches, wire cut switch, and idle stop release switch. A collective hold down strap is provided for the pilot collective.

2-31. TAIL ROTOR CONTROL SYSTEM.

Pushing a pedal changes the pitch of the tail rotor resulting in directional control and is used to pivot the helicopter on its own vertical axis and trim the helicopter in flight. A pedal adjuster is provided to adjust the pedal distance for individual comfort. Heel rests are provided for the gunner to prevent inadvertent pedal operation.

2-32. FORCE TRIM SYSTEM.

The system incorporates a magnetic brake and force gradient in the cyclic and directional control systems to provide artificial feel into the systems. Also, it provides a means to trim the controls. Placing the FORCE TRIM switch (figure 2-10) in the FORCE TRIM position will induce artificial feel into the systems. Depressing the cyclic stick force trim switch (figure 2-13) will cause the magnetic brake and force gradient to be repositioned to correspond to the positions of the cyclic stick and pedals thus providing trim. The system is powered by the dc essential bus and protected by the FORCE TRIM circuit breaker.

2-33. STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS).

a. Description. The SCAS is a three-axis, limited authority rate reference augmentation system. The SCAS cancels undesired motion of the helicopter during flight. This is accomplished by inducing an

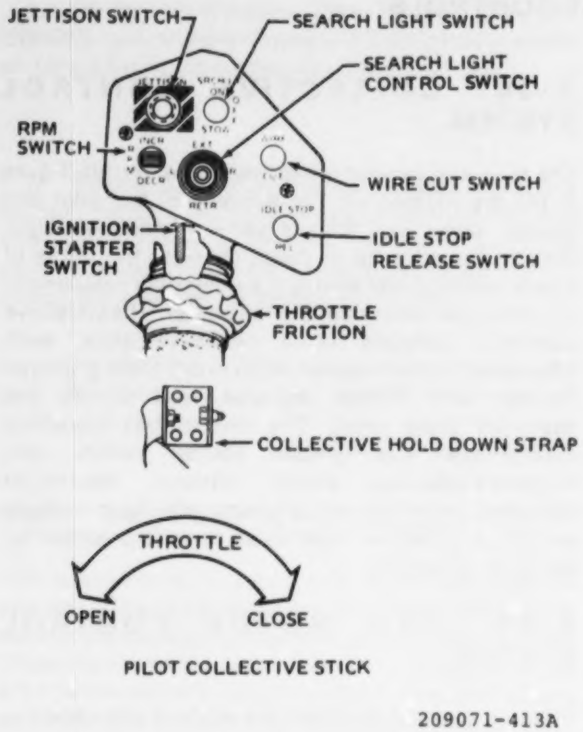

JETTISON SWITCH
SEARCH LIGHT SWITCH
SEARCH LIGHT CONTROL SWITCH
RPM SWITCH
WIRE CUT SWITCH
IGNITION STARTER SWITCH
IDLE STOP RELEASE SWITCH
THROTTLE FRICTION
COLLECTIVE HOLD DOWN STRAP
THROTTLE
OPEN
CLOSE
PILOT COLLECTIVE STICK
209071-413A

Figure 2-14. Pilot Collective Control Stick

electrical input into the flight control system to augment the pilot mechanical input.

b. Control Panel. The SCAS control panel (figure 2-15) contains a POWER switch for applying dc (essential bus) and ac power to the system. The circuits are protected by the SCAS POWER dc and SCAS PWR ac circuit breakers. The panel also contains three channel engage switches which energize electric solenoid valves controlling hydraulic pressure to the system. The panel has three amber colored NO-GO lights, one associated with each PITCH, ROLL, and YAW channel engage switch. These lights are illuminated during the warmup to indicate the presence of current in each associated channel actuator. Should an engagement be attempted during this warmup period, the actuator may make an abrupt input to the flight controls at the moment of engagement. When engagement is made, the NO-GO lights are locked out of the circuit and do not operate as malfunction indicators. Disengaging a channel, however, restores the associated light to operation. The NO-GO lights have a built-in press-to-test feature for ensuring that the indicator is operational, but this feature works only prior to channel engagement.

c. SCAS (SAS) Release Switch. The cyclic grip mounted switch (figure 2-13) is used to disengage the pitch, roll, and yaw channels simultaneously. The channels are re-engaged by the PITCH, ROLL, and YAW switches on the SCAS control panel.

d. M RECOIL COMP Switch. The RECOIL COMP switch is a three position switch (LO-MED-HI) located on the right side of the pilot instrument panel. It may be used to vary the magnitude of the signals from the Armament Compensation Unit to the SCAS to compensate for a lower/higher than average M197 firing rate.

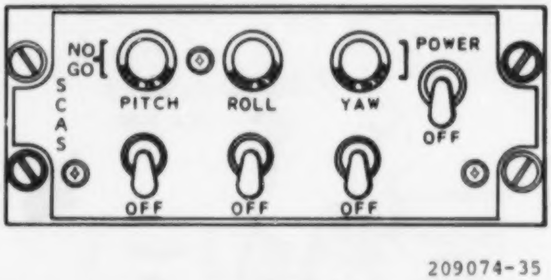

NO GO
SCAS
PITCH
ROLL
YAW
POWER
OFF
OFF
OFF
OFF
209074-35

Figure 2-15. Pilot SCAS Control Panel

SECTION VI. HYDRAULIC SYSTEMS

2-34. DESCRIPTION.

The hydraulic system is a dual system (No. 1 and No. 2 system) used to minimize the force required by the pilot to move the cyclic, collective, and pedal controls. The No. 1 and No. 2 systems are installed to provide maximum separation to reduce the probability of a single projectile from incapacitating both systems.

2-35. HYDRAULIC SYSTEM NO. 1.

The No. 1 system provides hydraulic power to the cyclic controls, collective controls, pedal controls, and SCAS yaw controls. The No. 1 system is located on the left side of the helicopter.

2-36. HYDRAULIC SYSTEM NO. 2.

The No. 2 system provides hydraulic power to the cyclic controls, collective controls, SCAS pitch and roll controls, articulated wing pylons and turret system P . The No. 2 system is located on the right side of the helicopter.

2-37. TEST SWITCH.

The pilot HYD TEST switch (figure 2-10) is used to test the No. 1 and No. 2 hydraulic systems. Holding the switch in the SYS 1 position will cause the No. 1 system to be the only system supplying hydraulic pressure. Similar action occurs when the switch is held in the SYS 2 position.

2-38. RESERVOIR FLUID SIGHT GLASSES.

The No. 1 and No. 2 reservoirs are provided with a fluid sight glass. Both sight glasses can be seen only from the left hydraulic compartment door.

2-39. FILTER INDICATORS.

The No. 1 and No. 2 pressure and return filters are provided with a differential pressure indicator. The red indicator pops out when the filter needs changing or during cold weather operation.

2-40. LOW PRESSURE CAUTION LIGHTS.

The pilot NO. 1 HYDR PRESS and NO. 2 HYDR PRESS, gunner HYDR PRESS #1 and HYDR PRESS # 2 P caution lights and # 1 HYDR PRESS AND #2 HYD PRESS E M caution lights (figure 2-23) will illuminate when the hydraulic pressure is below safe limits.

2-41. ELECTRICAL CIRCUIT.

The hydraulic electrical circuit is powered by the dc essential bus and protected by the HYDR CONT P HYD E HYD CONTR M circuit breaker.

2-42. EMERGENCY HYDRAULIC SYSTEM.

The emergency hydraulic system serves two functions. It provides hydraulic power to the turret P and outboard pylons for boresighting, or to the collective pitch control if both hydraulic systems fail. The system is controlled by the EMER HYDR PUMP switches (figures 2-7 and 2-12) powered by the dc essential bus and protected by the EMER HYD PUMP P M EMERG HYD PUMP E circuit breaker.

2-43. ARMAMENT HYDRAULIC SYSTEM.

a. **Turret System.** P The system is powered by the No. 2 system and enables the turret to be traversed through varied positions in elevation and azimuth. The system is controlled by the turret controls. The system electrical circuit is powered by the dc essential and non-essential buses and the ac system. The circuit is protected by the dc HYDR CONT, dc WPN CONT, ac HSS, and ac WPN FIRE circuit breakers.

b. **TOW Missile System.** The system is powered by the No. 2 system and is used to position the outboard articulated wing pylons during TOW missile operations. The system is controlled by the TOW missile controls. The system electrical circuits are powered by the dc essential bus and the ac system. The circuits are protected by the dc HYDR CONT, ac TOW PWR, and ac SECU circuit breakers P and dc HYD E HYD CONTR M , ac TMS PWR, and SECU PWR circuit breakers E M .

SECTION VII. POWER TRAIN SYSTEM

2-44. TRANSMISSION.

The transmission transfers engine power to the main rotor through the mast assembly and to the tail rotor through a series of driveshafts and gearboxes. The transmission has a self-contained pressure oil system. The oil is cooled by an oil cooler and bleed air turbine fan. The transmission and engine oil coolers use the same fan. The oil system has an automatic bypass system which causes the oil to bypass the cooler when a leak is sensed in the oil cooler circuit. Two oil level sight glasses, an oil filler cap, and a magnetic chip detector are provided.

2-45. GEARBOXES.

a. Intermediate Gearbox — 42 Degree. The gearbox is located at the base of the vertical fin (figure 2-1). It provides a 42 degree change of direction of the tail rotor driveshaft. The gearbox has a self-contained wet sump oil system. An oil level sight glass, a filler cap, and a magnetic chip detector are provided.

b. Tail Rotor Gearbox — 90 Degree. The gearbox is located near the top of the vertical fin (figure 2-1). It provides a 90 degree change of direction of the tail rotor driveshaft. The gearbox has a self-contained wet sump oil system. An oil level sight glass, a filler cap, and a magnetic chip detector are provided.

2-46. DRIVESHAFTS.

a. Main Driveshaft. The main driveshaft connects the engine output shaft to the transmission input drive quill.

b. Tail Rotor Driveshaft. The tail rotor driveshaft consists of five driveshafts and three hanger bearing assemblies. The assemblies and the 42 and 90 degree gearboxes connect the transmission tail rotor drive quill to the tail rotor.

2-47. INDICATORS AND CAUTION LIGHTS.

a. Transmission Oil Pressure/Temperature Indicator (figure 2-6). The pilot indicator displays the pressure in psi and temperature in degrees celsius of the transmission oil. The electrical circuit is powered by the dc essential bus and protected by the TEMP IND ENG/XMSN circuit breaker.

b. Transmission Oil Low Pressure Caution Lights. The pilot and gunner XMSN OIL PRESS P TRANS OIL PRESS E M caution lights (figure 2-23) illuminate when the transmission oil pressure drops below safe limits.

c. Transmission Oil Hot Caution Lights. The pilot XMSN OIL HOT and gunner XMSN OIL TEMP P TRANS OIL HOT E M caution lights (figure 2-23) illuminate when the transmission oil temperature exceeds the safe limits.

d. Transmission and Gearboxes Chip Detectors.

(1) The pilot chip detector caution lights (figure 2-23) illuminate when sufficient metal chips are detected in the 42 degree gearbox, 90 degree gearbox, or the transmisison oil.

(2) The pilot caution lights are worded: 42° CHIP, 90 ° CHIP, XMSN CHIP P and TRANS CHIP E M for the respective unit.

(3) The gunner chip detector caution light (figure 2-23) will only illuminate CHIP DETECTOR. This caution light does not identify the contaminated component.

SECTION VIII. MAIN AND TAIL ROTORS

2-48. MAIN ROTOR.

a. Description.

(1) B540 The main rotor blades are metal, bonded assemblies. Each blade is attached in the hub with a retaining bolt assembly and is held in alignment by adjustable drag braces.

(2) K747 The main rotor blades are glass fiber epoxy resin bonded assemblies with a rubber erosion guard. The skin is basket weave which will not be as smooth as a metal blade. Each blade is attached in the hub with a retaining bolt assembly and is held in alignment by adjustable drag braces.

(3) The main rotor is driven by the mast which is connected to the transmission. The rotor rpm is governed by the engine rpm during powered flight. The rotor tip path plane is controlled by the cyclic stick. The rotor pitch is controlled by the collective stick.

b. **RPM Indicators.** The pilot and gunner indicators are part of the dual tachometers (figures 2-6 and 2-7). The tachometer inner scale displays percent rotor rpm.

2-49. TAIL ROTOR.

The tail rotor is driven by the 90 degree gearbox which is connected to the transmission by the tail rotor driveshaft assemblies and the 42 degree gearbox. The rotor rpm is governed by the transmission rpm. The rotor blade pitch is controlled by the pedals.

SECTION IX. UTILITY SYSTEM

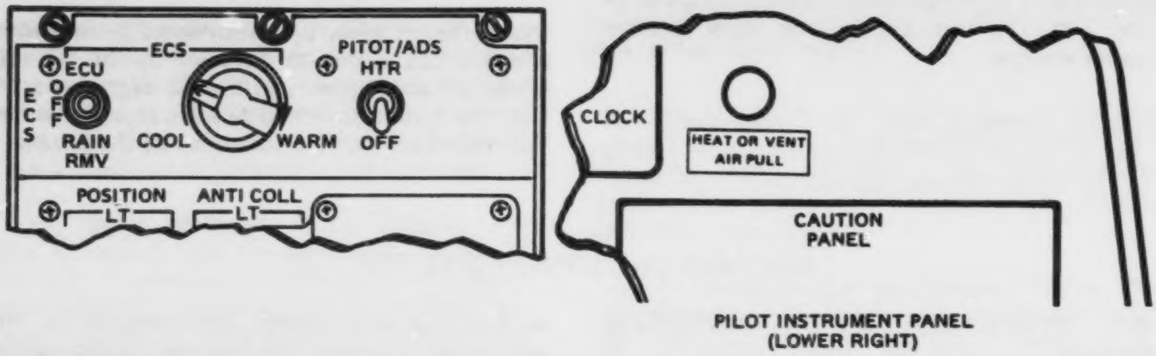
2-50. PITOT TUBE/AIR DATA SYSTEM HEATER.

a. **Pitot Tube Heater.** The pitot tube (figure 2-1) is equipped with an electrical heater. The pilot PITOT P E PITOT/ADS M switch (figure 2-16) in HTR position activates the heater in the tube and prevents ice from accumulating in the pitot tube. The OFF position deactivates the heater. The electrical circuit is powered by the dc nonessential bus and protected by the PITOT HTR circuit breaker.

b. **Air Data System (ADS) Heater** M . The air data system sensing head contains an electrical heater. The pilot PITOT/ADS switch (figure 2-16) in the HTR position activates the ADS heater, in addition to the pitot tube heater, and prevents ice from accumulating in the pitot tube and air data system. The OFF position deactivates the heater. The system is powered by the dc nonessential bus, ac system, and protected by the ADS PWR and ADS ANTI-ICE circuit breaker.

2-51. CANOPY DEFROSTING, DEICING AND RAIN REMOVAL SYSTEMS.

These systems are considered to be part of the environmental control system. See section X of this chapter.


ECS
ECU
OFF
ECS
RAIN RMV
COOL
WARM
PITOT/ADS HTR
OFF
POSITION LT
ANTI COLL LT
CLOCK
HEAT OR VENT AIR PULL
CAUTION PANEL
PILOT INSTRUMENT PANEL (LOWER RIGHT)

SWITCH/CONTROL	POSITION	FUNCTION
COOL/WARM	COOL to WARM	Controls temperature (35°F — 180°F) in the crew compartment when the ECU/RAIN RMV switch is in the ECU position.
M ECU/RAIN RMV P E HTR/RAIN RMV	RAIN RMV	Removes rain from canopy. Only ambient air ventilation enters the crew compartment. May be used to defrost, defog, or deice the forward area of the canopy.
	M ECU P E HTR	Heats or cools the crew compartment.
	OFF	Ambient air ventilation enters the crew compartment.
HEAT OR VENT AIR PULL	OUT	Directs maximum air to the defrost slots, air vents, and pilot/gunner seat cushions.
	IN	Directs maximum air to the pilot seat cushion.
Air Vent	Open/Closed	Controls the volume/direction of air to the crew compartment.
Defrost Slot Lever	Aft (Open)/ Forward (closed)	Controls the volume of air directed to the inner surfaces of the canopy for defogging, defrosting, and deicing.

209070-184C

Figure 2-16. ECS Controls (Typical)

SECTION X. HEATING, VENTILATION, COOLING, ENVIRONMENTAL CONTROL UNIT

2-52. ENVIRONMENTAL CONTROL SYSTEM (ECS).

a. ECS Functions.

(1) Heats/cools the crew compartment.

(2) Removes moisture from the air supplied to the crew compartment.

(3) Defrosts, defogs, and deices the canopy.

(4) Rain removal.

(5) Provides ambient air ventilation to the crew compartment.

b. ECS Power Source. The ECS is electrically controlled and engine bleed air powered. The circuit is powered by the dc nonessential bus and protected by the ECS CONT P ECS CONTR E . M circuit breaker.

c. ECS Controls.

NOTE

Under certain conditions a plume may be observed at the air vents in the crew compartment. The plume may appear to be smoke, but is actually condensation.

(1) The pilot ECS controls and their functions are shown on figure 2-16.

(2) Adjustable air vents are provided for the pilot and gunner to control the volume and direction of the air entering the crew compartment.

(3) Air entering the pilot and gunner seat cushions is controlled by a valve at the top of each seat.

(4) Rain removal. The rain removal does not remove rain in flight.

SECTION XI. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-53. DC AND AC POWER DISTRIBUTION P

Figure 2-17 depicts the general schematic of the dc and ac power distribution system. The dc power is supplied by the battery, starter-generator, or an external power source through the external power receptacle. The 115 vac power is supplied by the main or standby inverters. The 26 vac power is supplied by the 28 vac transformer.

2-54. DC AND AC POWER DISTRIBUTION. E M

Figure 2-17 depicts the general schematic of the dc and ac power distribution system. The dc power is supplied by the battery, starter-generator, alternator through the transformer rectifier unit (TRU), or an external power source through the external power receptacle. The 115 vac power is supplied by the alternator or inverter. The 26 vac power is supplied by the 28 vac transformer.

2-55. BATTERY.

The battery (figure 2-17) supplies 24 vdc power to the power distribution system when the starter-generator P , TRU E M and the external power receptacle are not in operation.

2-56. STARTER-GENERATOR.

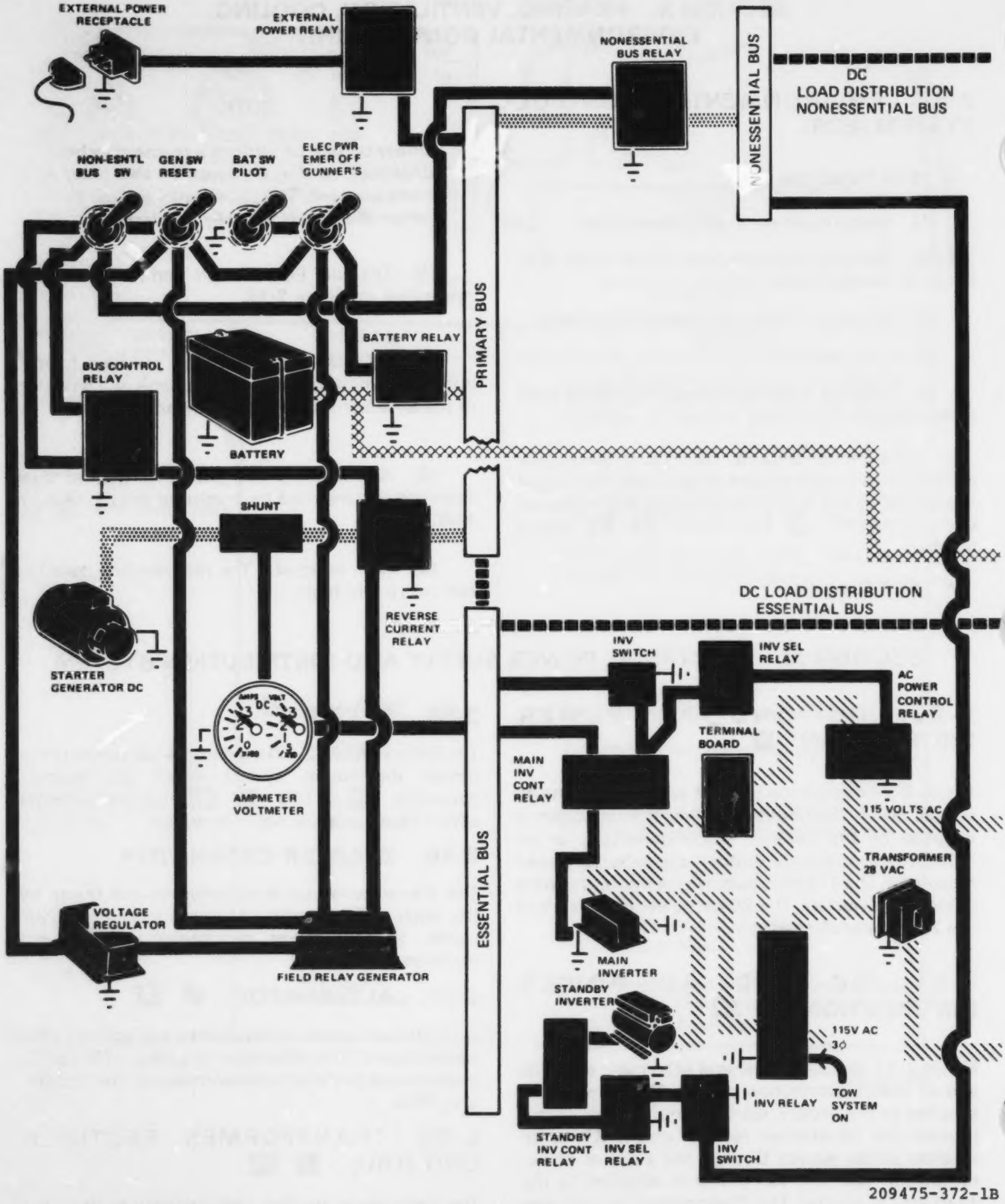
The starter-generator is mounted on and driven by the engine. The starter-generator supplies 28 vdc power to the power distribution system and recharges the battery.

2-57. ALTERNATOR. E M

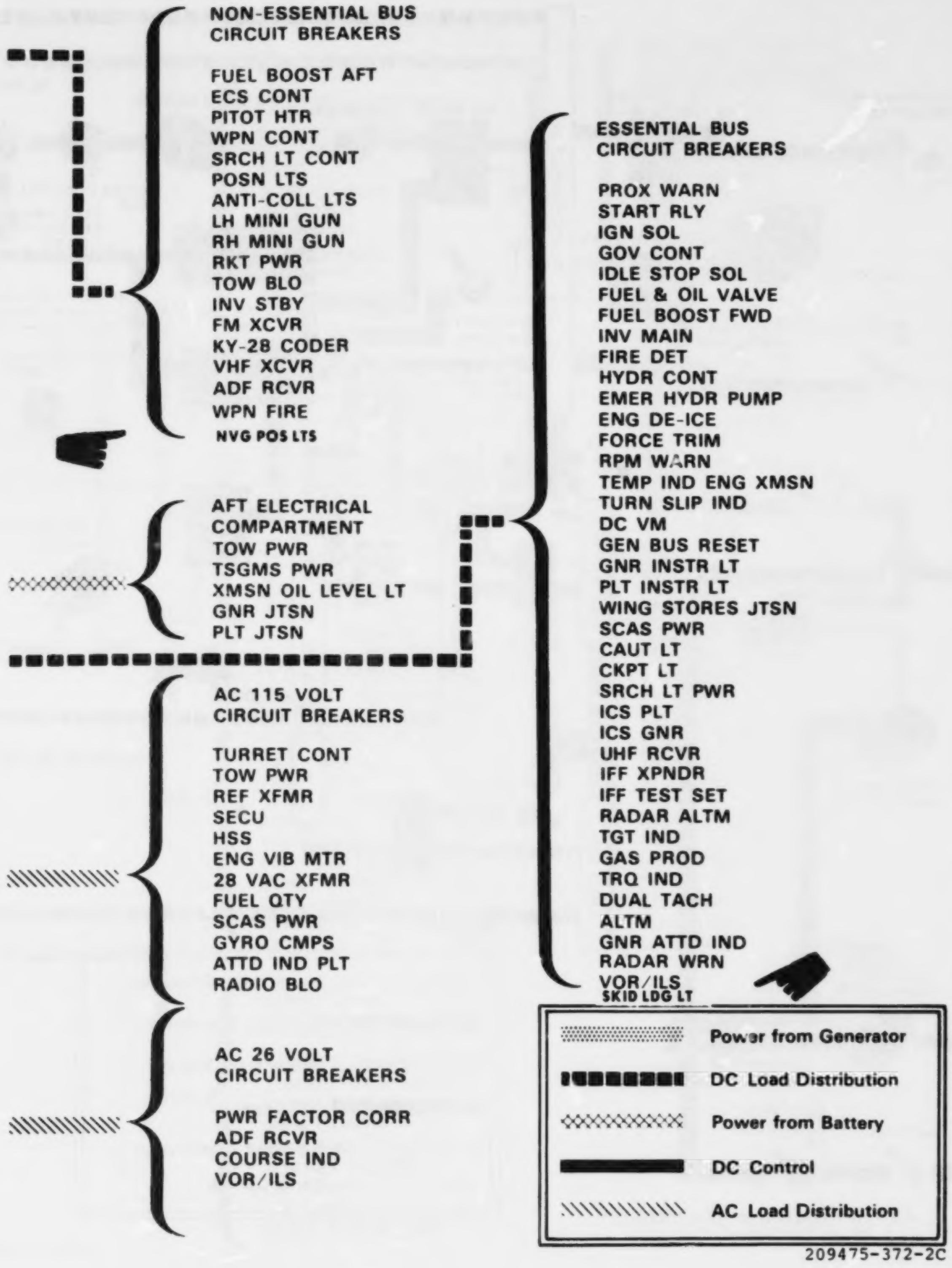
A 10 kVA alternator is mounted on and driven by the transmission. The alternator supplies 115 vac 3-phase power to the ac buses and transformer rectifier unit (TRU).

2-58. TRANSFORMER RECTIFIER UNIT (TRU). E M

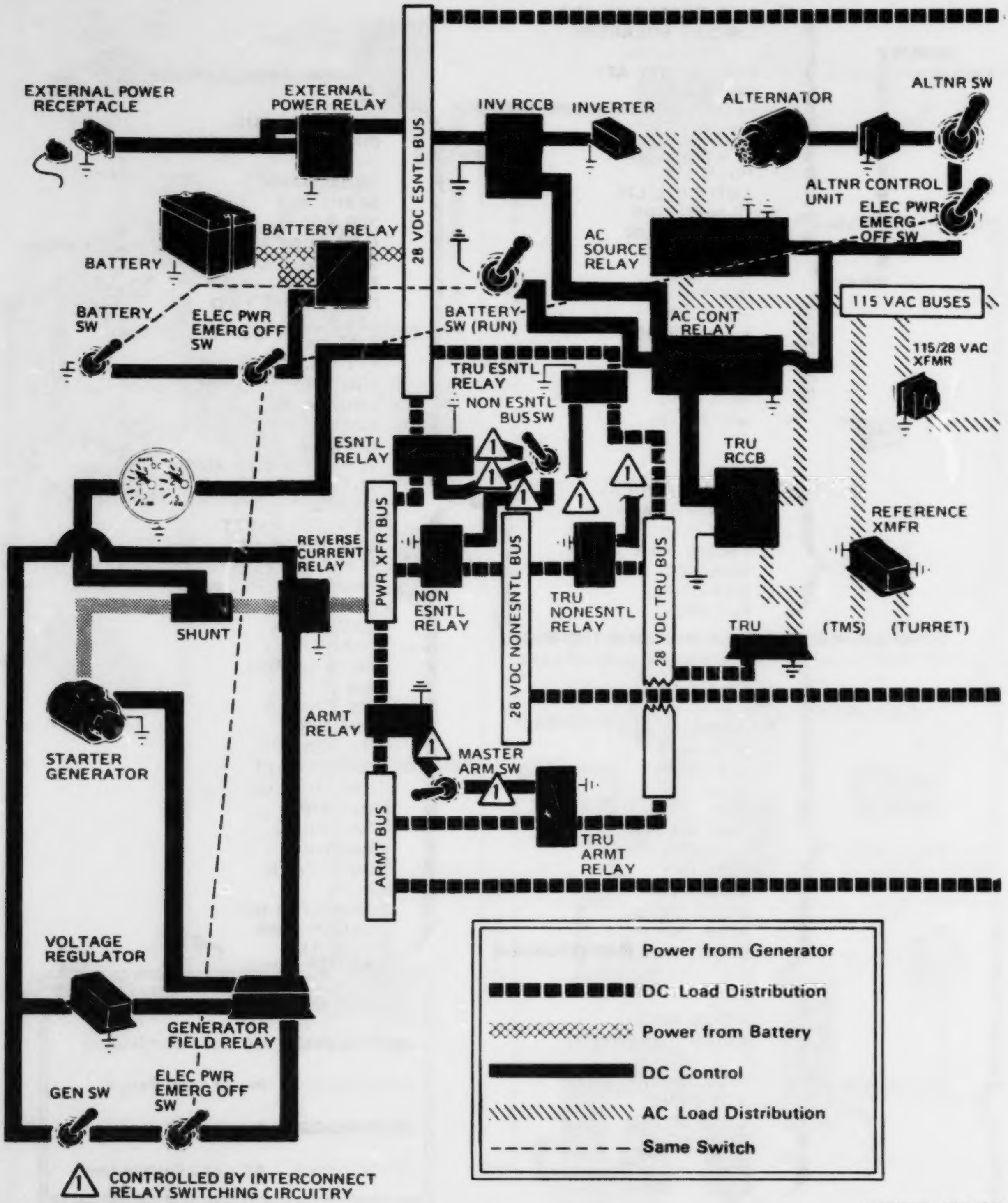
The transformer rectifier unit converts ac (from the alternator) to 28 vdc to power the TRU bus.


EXTERNAL POWER RECEPTACLE
EXTERNAL POWER RELAY
NONESSENTIAL BUS RELAY
NONESSENTIAL BUS
DC
LOAD DISTRIBUTION
NONESSENTIAL BUS
NON-ESNTL BUS SW
GEN SW RESET
BAT SW PILOT
ELEC PWR EMER OFF GUNNER'S
PRIMARY BUS
BATTERY RELAY
BUS CONTROL RELAY
BATTERY
SHUNT
REVERSE CURRENT RELAY
STARTER GENERATOR DC
DC LOAD DISTRIBUTION
ESSENTIAL BUS
INV SWITCH
INV SEL RELAY
AC POWER CONTROL RELAY
TERMINAL BOARD
MAIN INV CONT RELAY
DC
AMPMETER VOLTMETER
115 VOLTS AC
TRANSFORMER 28 VAC
ESSENTIAL BUS
VOLTAGE REGULATOR
FIELD RELAY GENERATOR
MAIN INVERTER
STANDBY INVERTER
115V AC 3ϕ
TOW SYSTEM ON
INV RELAY
STANDBY INV CONT RELAY
INV SEL RELAY
INV SWITCH
209475-372-1B

P Figure 2-17. DC and AC Power Distribution Schematic (Sheet 1 of 6)

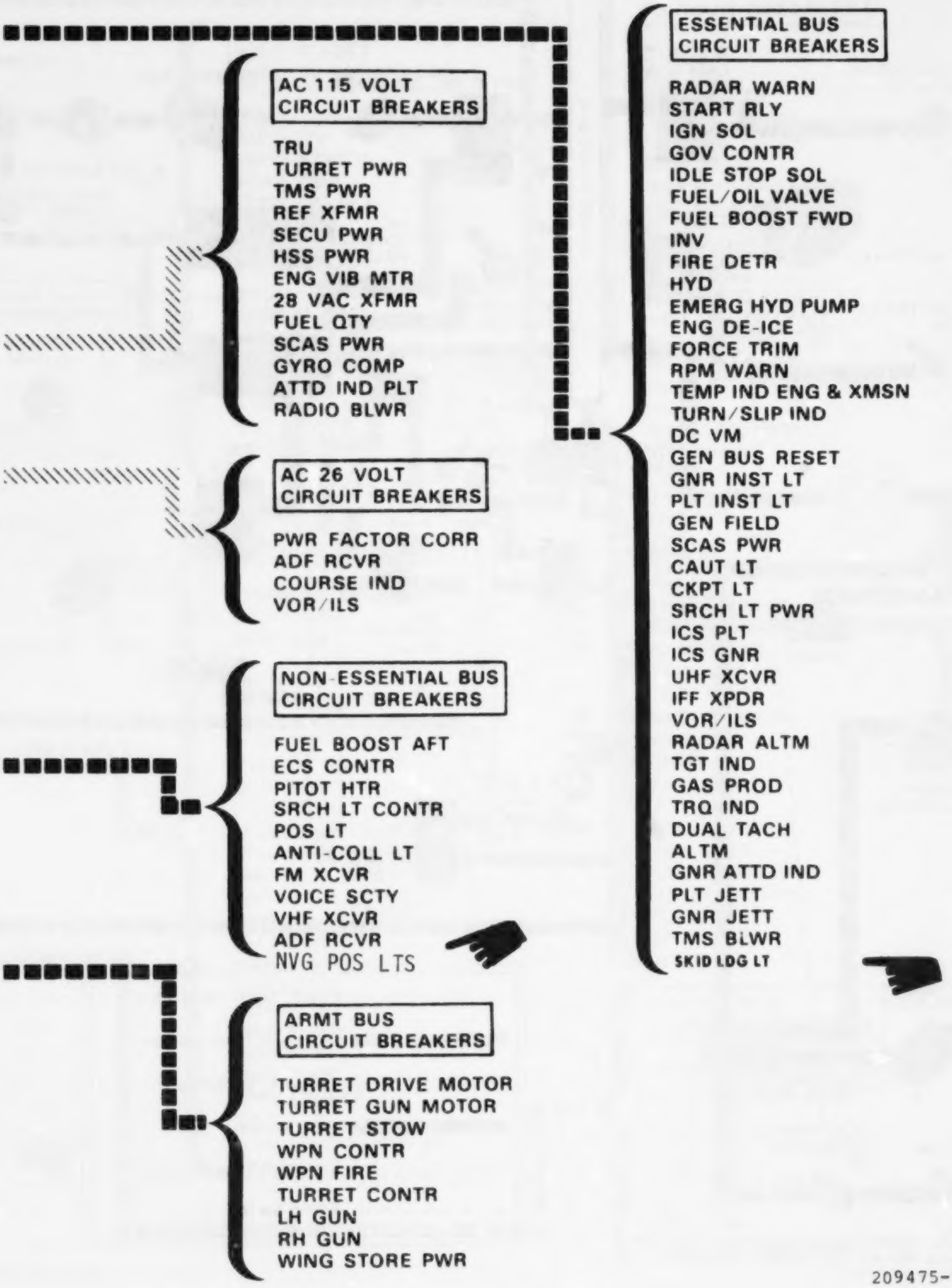

NON-ESSENTIAL BUS
CIRCUIT BREAKERS
FUEL BOOST AFT
ECS CONT
PITOT HTR
WPN CONT
SRCH LT CONT
POSN LTS
ANTI-COLL LTS
LH MINI GUN
RH MINI GUN
RKT PWR
TOW BLO
INV STBY
FM XCVR
KY-28 CODER
VHF XCVR
ADF RCVR
WPN FIRE
NVG POS LTS
AFT ELECTRICAL
COMPARTMENT
TOW PWR
TSGMS PWR
XMSN OIL LEVEL LT
GNR JTSN
PLT JTSN
AC 115 VOLT
CIRCUIT BREAKERS
TURRET CONT
TOW PWR
REF XFMR
SECU
HSS
ENG VIB MTR
28 VAC XFMR
FUEL QTY
SCAS PWR
GYRO CMPS
ATTD IND PLT
RADIO BLO
AC 26 VOLT
CIRCUIT BREAKERS
PWR FACTOR CORR
ADF RCVR
COURSE IND
VOR/ILS
ESSENTIAL BUS
CIRCUIT BREAKERS
PROX WARN
START RLY
IGN SOL
GOV CONT
IDLE STOP SOL
FUEL & OIL VALVE
FUEL BOOST FWD
INV MAIN
FIRE DET
HYDR CONT
EMER HYDR PUMP
ENG DE-ICE
FORCE TRIM
RPM WARN
TEMP IND ENG XMSN
TURN SLIP IND
DC VM
GEN BUS RESET
GNR INSTR LT
PLT INSTR LT
WING STORES JTSN
SCAS PWR
CAUT LT
CKPT LT
SRCH LT PWR
ICS PLT
ICS GNR
UHF RCVR
IFF XPNDR
IFF TEST SET
RADAR ALTM
TGT IND
GAS PROD
TRQ IND
DUAL TACH
ALTM
GNR ATTD IND
RADAR WRN
VOR/ILS
SKID LDG LT
Power from Generator
DC Load Distribution
Power from Battery
DC Control
AC Load Distribution
209475-372-2C

P Figure 2-17. DC and AC Power Distribution Schematic (Sheet 2 of 6)


EXTERNAL POWER RECEPTACLE
EXTERNAL POWER RELAY
28 VDC ESNTL BUS
INV RCCB
INVERTER
ALTERNATOR
ALTNR SW
ALTNR CONTROL UNIT
ELEC PWR EMERG-OFF SW
BATTERY
BATTERY RELAY
AC SOURCE RELAY
BATTERY SW
ELEC PWR EMERG OFF SW
BATTERY-SW (RUN)
AC CONT RELAY
115 VAC BUSES
115/28 VAC XFMR
TRU ESNTL RELAY
NON ESNTL BUS SW
ESNTL RELAY
1
TRU RCCB
REFERENCE XMFR
REVERSE CURRENT RELAY
PWR XFR BUS
NON ESNTL RELAY
28 VDC NONESNTL BUS
TRU NONESNTL RELAY
28 VDC TRU BUS
SHUNT
TRU
(TMS)
(TURRET)
STARTER GENERATOR
ARMT RELAY
MASTER ARM SW
ARMT BUS
TRU ARMT RELAY
VOLTAGE REGULATOR
GENERATOR FIELD RELAY
GEN SW
ELEC PWR EMERG OFF SW
Power from Generator
DC Load Distribution
Power from Battery
DC Control
AC Load Distribution
Same Switch
1 CONTROLLED BY INTERCONNECT RELAY SWITCHING CIRCUITRY

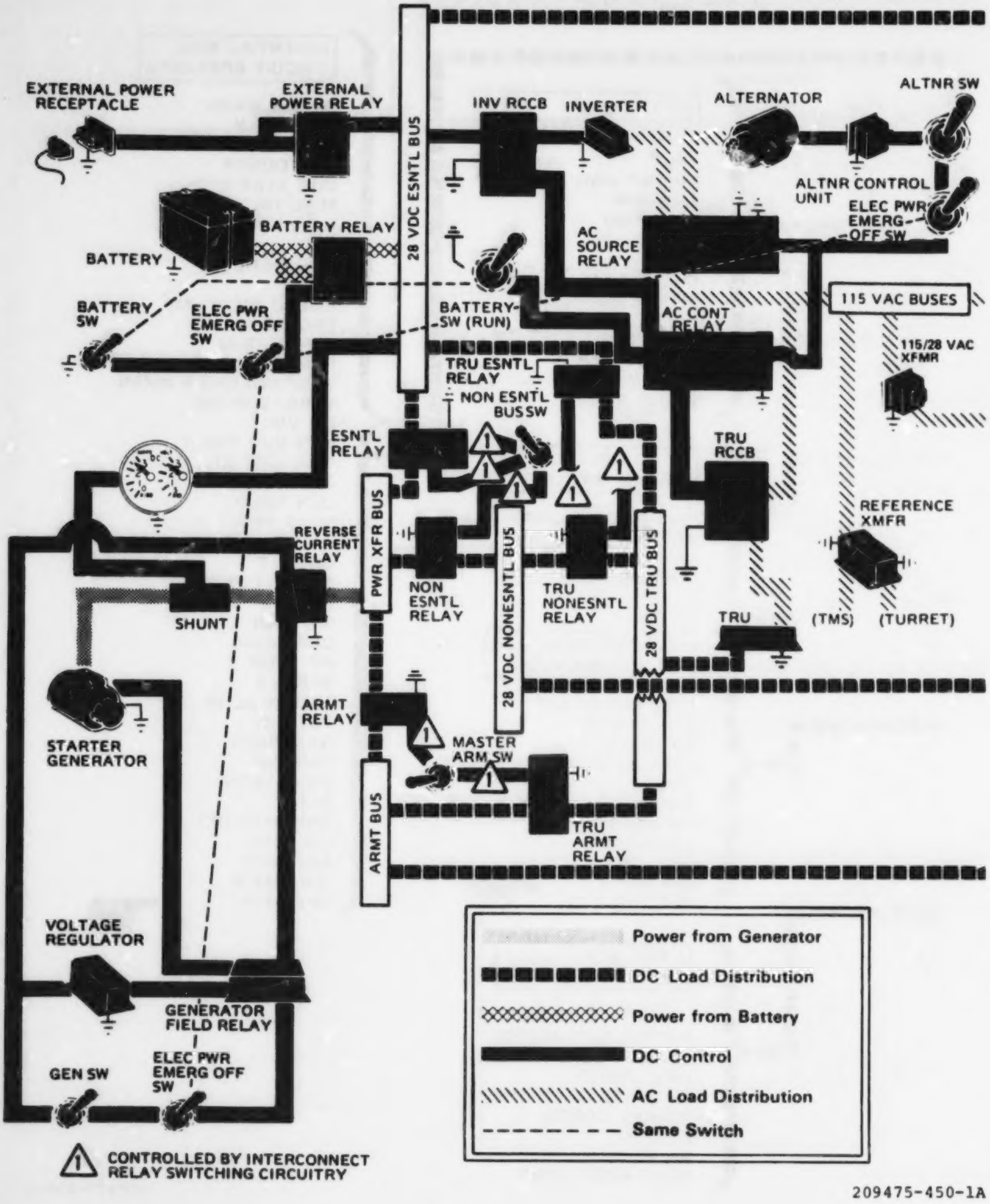
209475-450-1A

E Figure 2-17. DC and AC Power Distribution Schematic (Sheet 3 of 6)

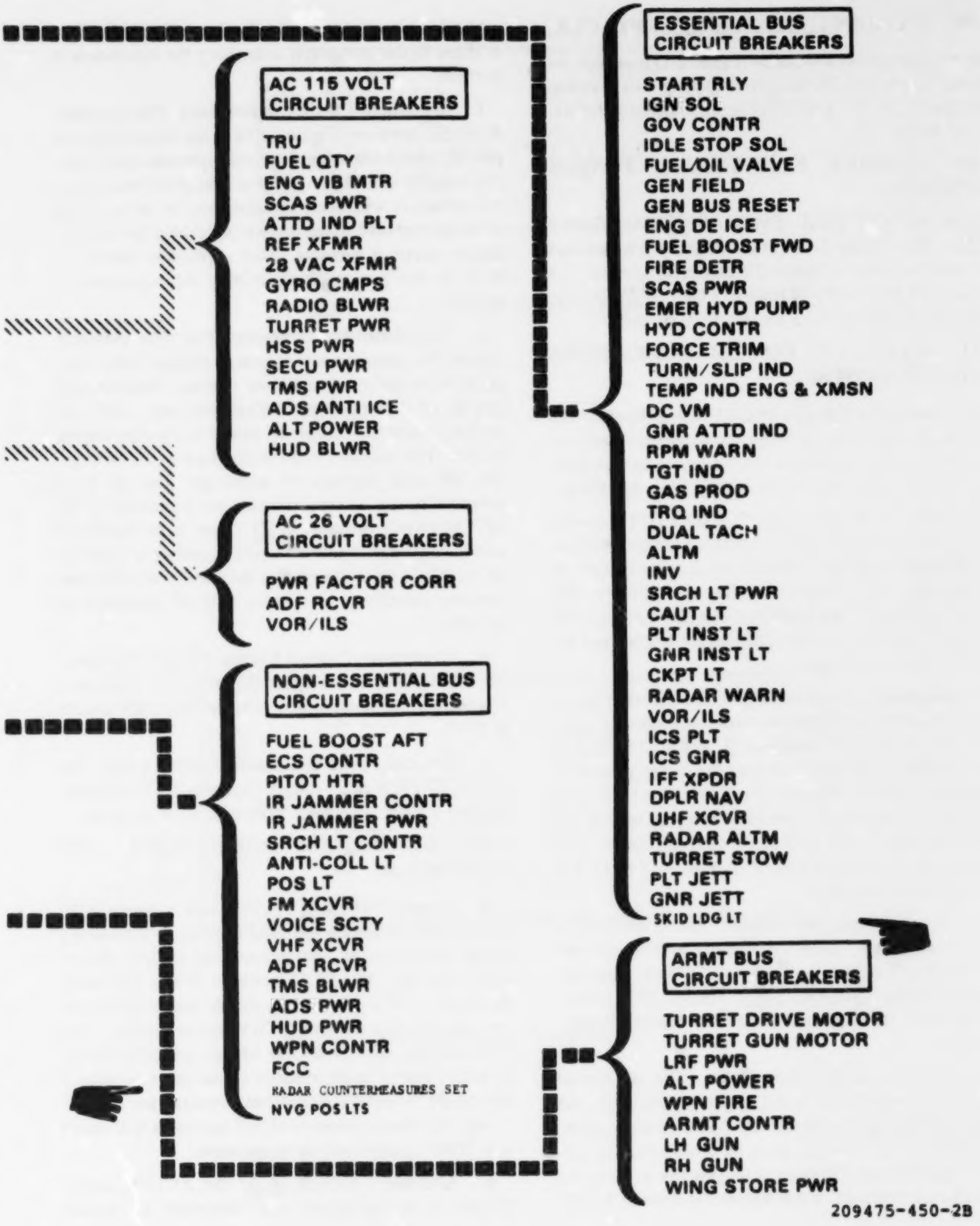

AC 115 VOLT CIRCUIT BREAKERS
TRU
TURRET PWR
TMS PWR
REF XFMR
SECU PWR
HSS PWR
ENG VIB MTR
28 VAC XFMR
FUEL QTY
SCAS PWR
GYRO COMP
ATTD IND PLT
RADIO BLWR
AC 26 VOLT CIRCUIT BREAKERS
PWR FACTOR CORR
ADF RCVR
COURSE IND
VOR/ILS
NON-ESSENTIAL BUS CIRCUIT BREAKERS
FUEL BOOST AFT
ECS CONTR
PITOT HTR
SRCH LT CONTR
POS LT
ANTI-COLL LT
FM XCVR
VOICE SCTY
VHF XCVR
ADF RCVR
NVG POS LTS
ARMT BUS CIRCUIT BREAKERS
TURRET DRIVE MOTOR
TURRET GUN MOTOR
TURRET STOW
WPN CONTR
WPN FIRE
TURRET CONTR
LH GUN
RH GUN
WING STORE PWR
ESSENTIAL BUS CIRCUIT BREAKERS
RADAR WARN
START RLY
IGN SOL
GOV CONTR
IDLE STOP SOL
FUEL/OIL VALVE
FUEL BOOST FWD
INV
FIRE DETR
HYD
EMERG HYD PUMP
ENG DE-ICE
FORCE TRIM
RPM WARN
TEMP IND ENG & XMSN
TURN/SLIP IND
DC VM
GEN BUS RESET
GNR INST LT
PLT INST LT
GEN FIELD
SCAS PWR
CAUT LT
CKPT LT
SRCH LT PWR
ICS PLT
ICS GNR
UHF XCVR
IFF XPDR
VOR/ILS
RADAR ALTM
TGT IND
GAS PROD
TRQ IND
DUAL TACH
ALTM
GNR ATTD IND
PLT JETT
GNR JETT
TMS BLWR
SKID LDG LT

209475-450-2C

E Figure 2-17. DC and AC Power Distribution Schematic (Sheet 4 of 6)


EXTERNAL POWER RECEPTACLE
EXTERNAL POWER RELAY
28 VDC ESNTL BUS
INV RCCB
INVERTER
ALTERNATOR
ALTNR SW
ALTNR CONTROL UNIT
ELEC PWR EMERG-OFF SW
BATTERY
BATTERY RELAY
AC SOURCE RELAY
BATTERY SW
ELEC PWR EMERG OFF SW
BATTERY-SW (RUN)
AC CONT RELAY
115 VAC BUSES
115/28 VAC XFMR
TRU ESNTL RELAY
NON ESNTL BUS SW
ESNTL RELAY
TRU RCCB
REFERENCE XMFR
PWR XFR BUS
REVERSE CURRENT RELAY
28 VDC NONESNTL BUS
28 VDC TRU BUS
NON ESNTL RELAY
TRU NONESNTL RELAY
SHUNT
TRU
(TMS)
(TURRET)
STARTER GENERATOR
ARMT RELAY
MASTER ARM SW
ARMT BUS
TRU ARMT RELAY
VOLTAGE REGULATOR
GENERATOR FIELD RELAY
GEN SW
ELEC PWR EMERG OFF SW
1
Power from Generator
DC Load Distribution
Power from Battery
DC Control
AC Load Distribution
Same Switch
CONTROLLED BY INTERCONNECT RELAY SWITCHING CIRCUITRY
209475-450-1A

M Figure 2-17. DC and AC Power Distribution Schematic (Sheet 5 of 6)


AC 115 VOLT CIRCUIT BREAKERS
TRU
FUEL QTY
ENG VIB MTR
SCAS PWR
ATTD IND PLT
REF XFMR
28 VAC XFMR
GYRO CMPS
RADIO BLWR
TURRET PWR
HSS PWR
SECU PWR
TMS PWR
ADS ANTI ICE
ALT POWER
HUD BLWR
AC 26 VOLT CIRCUIT BREAKERS
PWR FACTOR CORR
ADF RCVR
VOR/ILS
NON-ESSENTIAL BUS CIRCUIT BREAKERS
FUEL BOOST AFT
ECS CONTR
PITOT HTR
IR JAMMER CONTR
IR JAMMER PWR
SRCH LT CONTR
ANTI-COLL LT
POS LT
FM XCVR
VOICE SCTY
VHF XCVR
ADF RCVR
TMS BLWR
ADS PWR
HUD PWR
WPN CONTR
FCC
RADAR COUNTERMEASURES SET
NVG POS LTS
ESSENTIAL BUS CIRCUIT BREAKERS
START RLY
IGN SOL
GOV CONTR
IDLE STOP SOL
FUEL/OIL VALVE
GEN FIELD
GEN BUS RESET
ENG DE ICE
FUEL BOOST FWD
FIRE DETR
SCAS PWR
EMER HYD PUMP
HYD CONTR
FORCE TRIM
TURN/SLIP IND
TEMP IND ENG & XMSN
DC VM
GNR ATTD IND
RPM WARN
TGT IND
GAS PROD
TRQ IND
DUAL TACH
ALTM
INV
SRCH LT PWR
CAUT LT
PLT INST LT
GNR INST LT
CKPT LT
RADAR WARN
VOR/ILS
ICS PLT
ICS GNR
IFF XPDR
DPLR NAV
UHF XCVR
RADAR ALTM
TURRET STOW
PLT JETT
GNR JETT
SKID LDG LT
ARMT BUS CIRCUIT BREAKERS
TURRET DRIVE MOTOR
TURRET GUN MOTOR
LRF PWR
ALT POWER
WPN FIRE
ARMT CONTR
LH GUN
RH GUN
WING STORE PWR
209475-450-2B

M Figure 2-17. DC and AC Power Distribution Schematic (Sheet 6 of 6)

2-59. EXTERNAL POWER RECEPTACLE.

The external power receptacle (figure 2-1) transmits the ground power unit 28 vdc power to the power distribution system. A 7.5 KW GPU is recommended for external starts.

2-60. GUNNER ELECTRICAL POWER CONTROL.

The gunner ELEC PWR - EMER OFF P EMERG OFF E M switch (figure 2-11) in the ELEC PWR position permits the pilot to control the electrical system. The switch in EMER OFF P EMERG OFF E M position removes all power from the electrical system.

2-61. PILOT DC POWER INDICATORS AND CONTROLS.

a. **Battery Switch.** P The BAT switch (figure 2-18) ON position permits the battery to supply dc power to the primary bus or permits the battery to be charged. The OFF position isolates the battery from the system.

b. **Battery Switch.** E M The BATTERY switch (figure 2-18) START or RUN position permits the battery to supply dc power to the power distribution system or permits the battery to be charged by the starter/generator. The RUN position also activates the inverter. The OFF position isolates the battery and inverter from the systems.

c. **Generator Switch.** The GEN switch (figure 2-18) ON position permits the starter-generator to supply dc power to the primary bus P ,PWR XFR BUS E M. The RESET position will reset the starter-generator. When the switch is released, it will return to OFF. The OFF position isolates the generator from the system and allows the starter-generator to function as a starter. The circuit is protected by the GEN BUS RESET and GEN FIELD circuit breakers.

d. **Nonessential Bus Switch.** The NONESNTL BUS switch (figure 2-18) NORMAL position permits the nonessential bus to receive dc power from the starter-generator P or TRU E M . The MANUAL position permits the nonessential bus to receive battery power.

e. **DC Circuit Breaker Panel.** The dc circuit breakers (figure 2-19) in the closed position provide circuit protection for the 28 vdc operated equipment. The breakers in the open position deactivates the circuit. The breakers will open automatically in the event of a circuit overload. Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

f. **Armament DC Circuit Breakers.** The armament dc circuit breakers (figure 2-19) in the closed position provide circuit protection for the dc operated equipment. The breaker in the open position deactivate the circuit. The breakers will open automatically in the event of a circuit overload. Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

g. **Volt-Ammeter Indicator.** The pilot indicator (figure 2-6) displays the dc power voltage being supplied to the power distribution system. Simultaneous display of dc amperage is displayed only when the starter-generator is supplying power to the distribution system. The indicator right scale displays the voltage. The left scale displays the amperage. The circuit is powered by the dc essential bus and protected by the DCVM circuit breaker. E M There is no means of monitoring amperage load when dc power is supplied by the TRU. Overcharging of the battery or a thermal runaway condition could occur with no indication to the pilot.

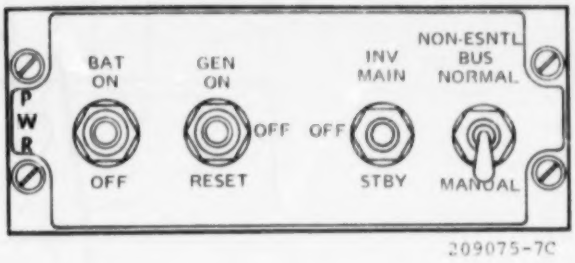
h. **Generator Caution Lights.** The pilot and gunner DC GEN caution lights (figure 2-23) illuminate when the dc generator fails or when the GEN switch is OFF.

i. **External Power Receptacle Caution Light.** The pilot EXT PWR caution light (figure 2-23) illuminates when the external power receptacle door is open.

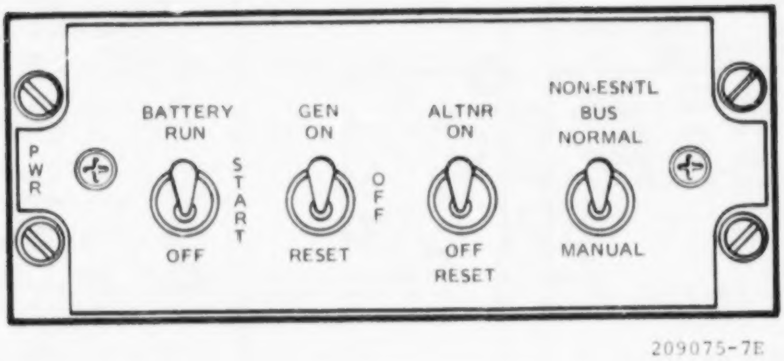
2-62. AC POWER INDICATORS AND CONTROLS.

a. **Inverter Switch.** P The INV switch (figure 2-18) MAIN position selects the main inverter. It is powered by the dc essential bus and protected by the INV MAIN circuit breaker. The STBY position selects the standby inverter. It is powered by the dc nonessential bus and protected by the INV STBY circuit breaker. The OFF position deactivates the MAIN and STANDBY inverter circuits. In the event of a main inverter failure, the standby inverter automatically assumes the ac load. Temporary interruption of SCAS operation will occur and TOW system will be inoperative.

b. **Alternator Switch.** E M The ALTNR switch (figure 2-18) energizes the alternator to supply

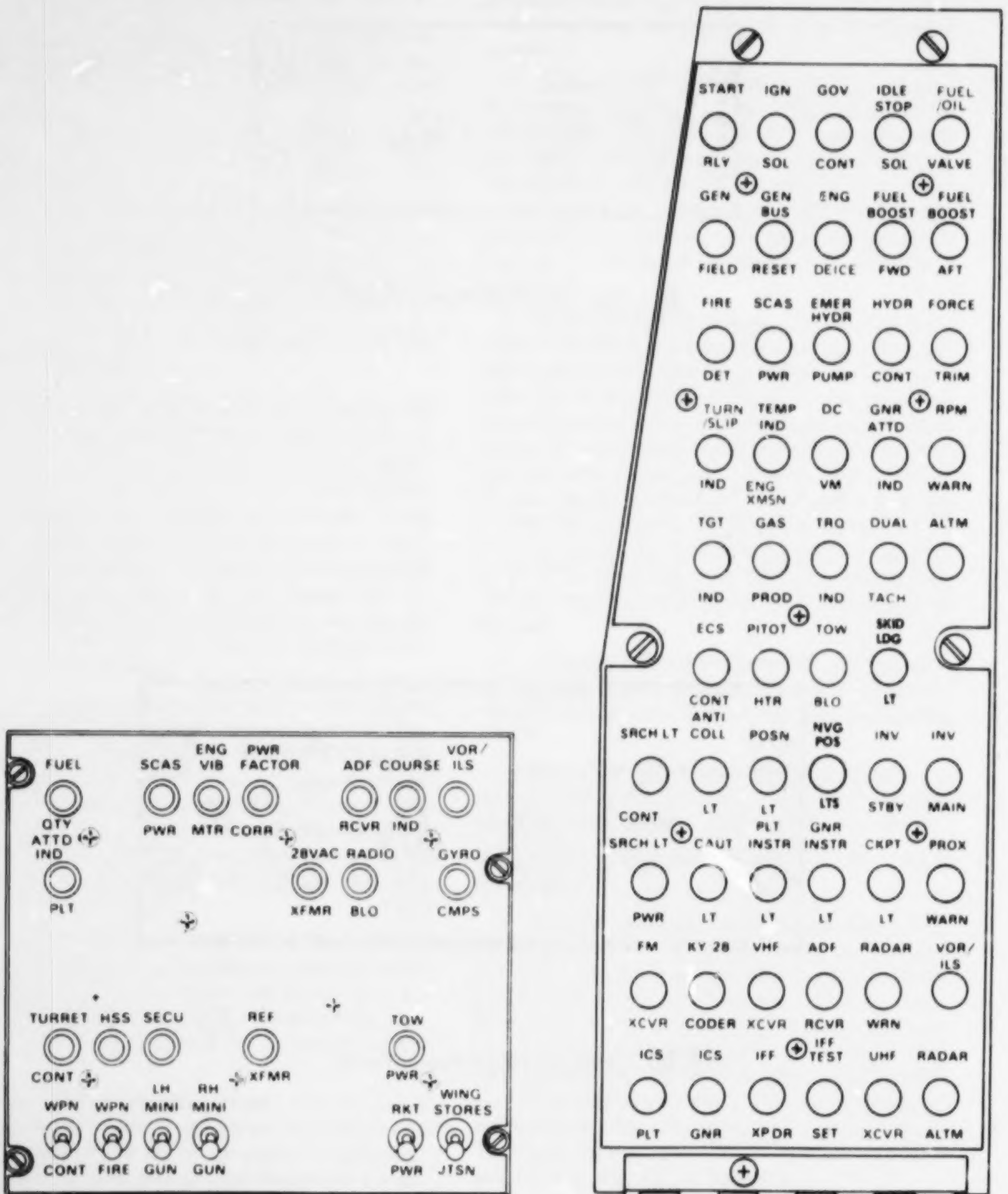

BAT
ON
OFF
GEN
ON
OFF
RESET
INV
MAIN
OFF
STBY
NON-ESNTL
BUS
NORMAL
MANUAL
PWR
209075-7C

P Pilot Electrical Power Panel


BATTERY
RUN
START
OFF
GEN
ON
OFF
RESET
ALTNR
ON
OFF
RESET
NON-ESNTL
BUS
NORMAL
MANUAL
PWR
209075-7E

E **M** Pilot Electrical Power Panel

Figure 2-18. Pilot Electrical Power Panel

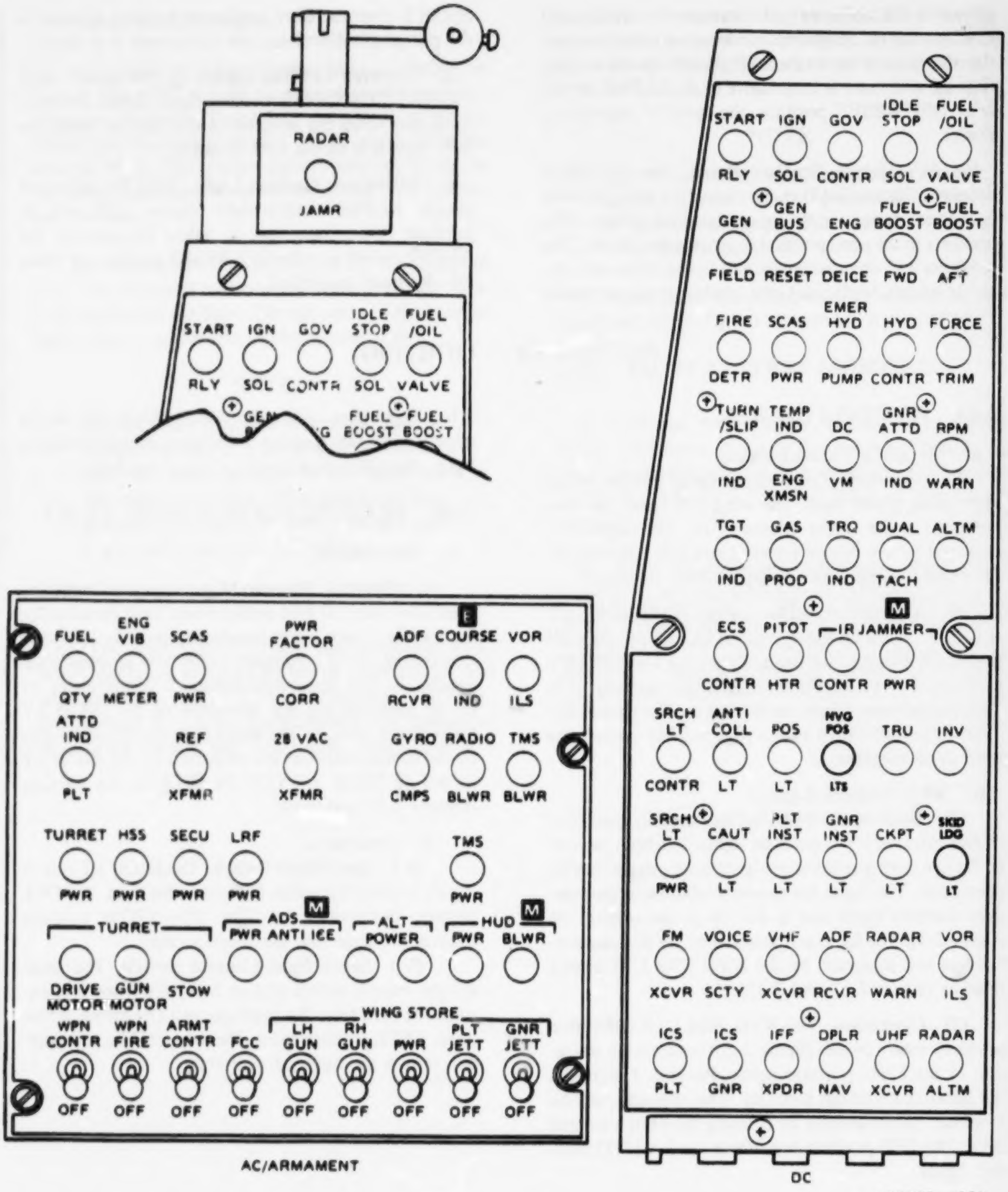

FUEL
QTY
SCAS
PWR
ENG
VIB
MTR
PWR
FACTOR
CORR
ADF
RCVR
COURSE
IND
VOR/
ILS
ATTD
IND
PLT
28VAC
XFMR
RADIO
BLO
GYRO
CMPS
TURRET
CONT
HSS
SECU
REF
XFMR
TOW
PWR
WPN
CONT
WPN
FIRE
LH
MINI
GUN
RH
MINI
GUN
RKT
PWR
WING
STORES
JTSN
START
RLY
IGN
SOL
GOV
CONT
IDLE
STOP
SOL
FUEL
/OIL
VALVE
GEN
FIELD
GEN
BUS
RESET
ENG
DEICE
FUEL
BOOST
FWD
FUEL
BOOST
AFT
FIRE
DET
SCAS
PWR
EMER
HYDR
PUMP
HYDR
CONT
FORCE
TRIM
TURN
/SLIP
IND
TEMP
IND
ENG
XMSN
DC
VM
GNR
ATTD
IND
RPM
WARN
TGT
IND
GAS
PROD
TRQ
IND
DUAL
TACH
ALTM
ECS
CONT
PITOT
HTR
TOW
BLO
SKID
LDG
LT
SRCH LT
CONT
ANTI
COLL
LT
POSN
LT
NVG
POS
LTS
INV
STBY
INV
MAIN
SRCH LT
PWR
CAUT
LT
PLT
INSTR
LT
GNR
INSTR
LT
CKPT
LT
PROX
WARN
FM
XCVR
KY 28
CODER
VHF
XCVR
ADF
RCVR
RADAR
WRN
VOR/
ILS
ICS
PLT
ICS
GNR
IFF
XPDR
IFF
TEST
SET
UHF
XCVR
RADAR
ALTM

AC/ARMAMENT

DC

209075-385D

P Figure 2-19. Circuit Breaker Panels (Sheet 1 of 2)


RADAR JAMR
START RLY
IGN SOL
GOV CONTR
IDLE STOP SOL
FUEL /OIL VALVE
GEN
FUEL BOOST
FUEL BOOST
FUEL QTY
ENG VIB METER
SCAS PWR
PWR FACTOR CORR
E
ADF RCVR
COURSE IND
VOR ILS
ATTD IND PLT
REF XFMR
28 VAC XFMR
GYRO CMPS
RADIO BLWR
TMS BLWR
TURRET PWR
HSS PWR
SECU PWR
LRF PWR
TMS PWR
TURRET
DRIVE MOTOR
GUN MOTOR
STOW
ADS
M
PWR
ANTI ICE
ALT POWER
HUD
M
PWR
BLWR
WING STORE
WPN CONTR OFF
WPN FIRE OFF
ARMT CONTR OFF
FCC OFF
LH GUN OFF
RH GUN OFF
PWR OFF
PLT JETT OFF
GNR JETT OFF
AC/ARMAMENT
START RLY
IGN SOL
GOV CONTR
IDLE STOP SOL
FUEL /OIL VALVE
GEN FIELD
GEN BUS RESET
ENG DEICE
FUEL BOOST FWD
FUEL BOOST AFT
FIRE DETR
SCAS PWR
EMER HYD PUMP
HYD CONTR
FORCE TRIM
TURN /SLIP IND
TEMP IND ENG XMSN
DC VM
GNR ATTD IND
RPM WARN
TGT IND
GAS PROD
TRQ IND
DUAL TACH
ALTM
M
ECS CONTR
PITOT HTR
IR JAMMER
CONTR
PWR
SRCH LT CONTR
ANTI COLL LT
POS LT
NVG POS LTS
TRU
INV
SRCH LT PWR
CAUT LT
PLT INST LT
GNR INST LT
CKPT LT
SKID LDG LT
FM XCVR
VOICE SCTY
VHF XCVR
ADF RCVR
RADAR WARN
VOR ILS
ICS PLT
ICS GNR
IFF XPDR
DPLR NAV
UHF XCVR
RADAR ALTM
DC

209075-433A

E M **Figure 2-19. Circuit Breaker Panels (Typical Sheet 2 of 2)** power to the ac buses and transformer rectifier unit (TRU) when in ON position. It deactivates and/or resets the alternator when in the OFF RESET position. Any time the alternator is inoperative or the ALTNR switch is in OFF RESET position, the inverter supplies ac power.

c. AC Circuit Breaker Panel. The ac circuit breakers (figures 2-19) in the closed position provides circuit protection for the ac operated equipment. The breakers in the open position deactivate the circuit. The breakers will open automatically in the event of a circuit overlaod. Each breaker is labeled for the particular circuit it protects. Each applicable breaker is listed in the paragraph describing the equipment it protects.

d. Inverter Caution Lights. P The pilot MAIN INVTR/STBY INVTR caution light (figure 2-23) illuminates when the inverter in use fails or when the INV switch is in the OFF position.

e. Alternator Caution Light. E M The pilot and gunner ALTER caution light (figure 2-23) will illuminate when rotor rpm is below 91 percent, the ALTNR switch is in the OFF RESET position, or when the alternator has failed.

SECTION XII. LIGHTING

2-63. POSITION LIGHTS.

a. Standard Position Lights.

(1) General. The position lights consist of the right wing green light, left wing red light, and two tailboom white lights (figure 2-1). The lights are powered by the dc nonessential bus and protected by the POSN LT P POS LT E M circuit breaker.

(2) Operation. The pilot POSITION LT (FLASH/OFF/STEADY) switch (figure 2-20) FLASH position flashes the four lights off and on. The STEADY position illuminates the four lights continously. The OFF position deactivates the four lights. The pilot POSITION LT (BRT/DIM) switch (figure 2-20) controls the four lights brightness.

b. NVG Position Lights.

(1) General. A covert lighting system, consisting of five infrared NVG position lights, has been provided for use during multi-ship night vision goggle (NVG) operations. The lights are mounted adjacent to the standard position lights and at the top of the vertical fin (figure 2-1). The lights are powered by the dc nonessential bus and protected by the NVG POS LTS circuit breaker (figure 2-17 and 2-19).

(2) Operation. The NVG POS LTS (OFF/five position) rotary switch (figure 2-20) controls the operation of the NVG position lights. Position 1 activates the lights at minimum intensity. The intensity may be increased incrementally by rotating the switch toward BRT. The OFF position deactivates the five NVG position lights.

2-64. ANTI—COLLISION LIGHT.

a. General. The anti-collision light (figure 2-1) is powered by the dc nonessential bus and protected by the ANTI-COLL LT circuit breaker.

b. Operation. The pilot ANTI-COLL LT switch (figure 2-20) ON position illuminates the anti-collision light. The OFF position deactivates the light.

2-65. SEARCHLIGHT/LANDING LIGHT.

a. Searchlight.

(1) General. The searchlight consists of an IR bypass filter and 150 watt sealed beam lamp installed on the standard searchlight housing to provide illumination during NVG operations under low ambient light conditions. The searchlight (figure 2-1) is powered by the dc essential bus and protected by the SRCH LT PWR circuit breaker. The searchlight control is powered by the nonessential bus and protected by the SRCH LT CONT P SRCH LT CONTR E M circuit breaker (figures 2-17 and 2-19).

(2) Operation.

(a) Searchlight Switch. The SRCH LT switch (figure 2-14) ON position illuminates the light. The OFF position deactivates the light. The STOW position retracts the light into the fuselage well.

(b) Searchlight Control Switch. The searchlight control switch (figure 2-14) EXT position extends the light from the fuselage well and moves it forward. RETR position moves the light aft. The L/R position moves the light left and right.

b. Skid Landing Light.

(1) **General.** A fixed landing light is installed on the left side of the aircraft attached to the forward landing gear crosstube (figure 2-1). This light provides a white light capability for use during night operation without NVG. The landing light is powered by the dc essential bus and protected by the SKID LDG LT circuit breaker.

(2) **Operation.** The SKID LDG LT switch (figure 2-4) ON position illuminates the light. The OFF position deactivates the light. The elevation of the landing light beam is adjustable on the ground only.

NOTE

The IR filter and 150 watt bulb may be installed on the skid landing light with the 450 watt bulb installed in the standard searchlight housing. This configurations provides a slewable white searchlight and a ground-adjustable IR light.

2-66. COCKPIT UTILITY LIGHTS.

a. **General.** The pilot (two) and the gunner (one) utility lights are powered by the dc essential bus and protected by the CKPT LT circuit breaker. The lights are supplied in various configurations. All configurations have on-off and bright/dim capabilities and provide NVG compatible light. Adjustable extensions have been provided for pilot (right) and gunner utility lights. An alternate light bracket is provided for the pilot (left) utility light.

NOTE

The cockpit utility light lens selector must be placed in the "white" position in order to provide adequate illumination with NVG filters installed.

b. **Operation.** The pilot/gunner determines the configuration of his light and operates it accordingly.

2-67. PILOT STATION LIGHTING.

a. **General.** The cockpit is illuminated by integral lights, post lights, flood lights, and bezel lights. The lights are protected by the dc essential bus and protected by the PLT INSTR LT P PLT INST LT E M circuit breaker.

b. **Night vision Feature.** NVG compatibility is provided by using blue-green lighting, in various configurations, to illuminate instruments, avionics and control panels. The ON/NVG ENBL OFF P and NVG ENBL/OFF E M switches (figure 2-20 and LTS switch (figure 2-13) have been disabled.

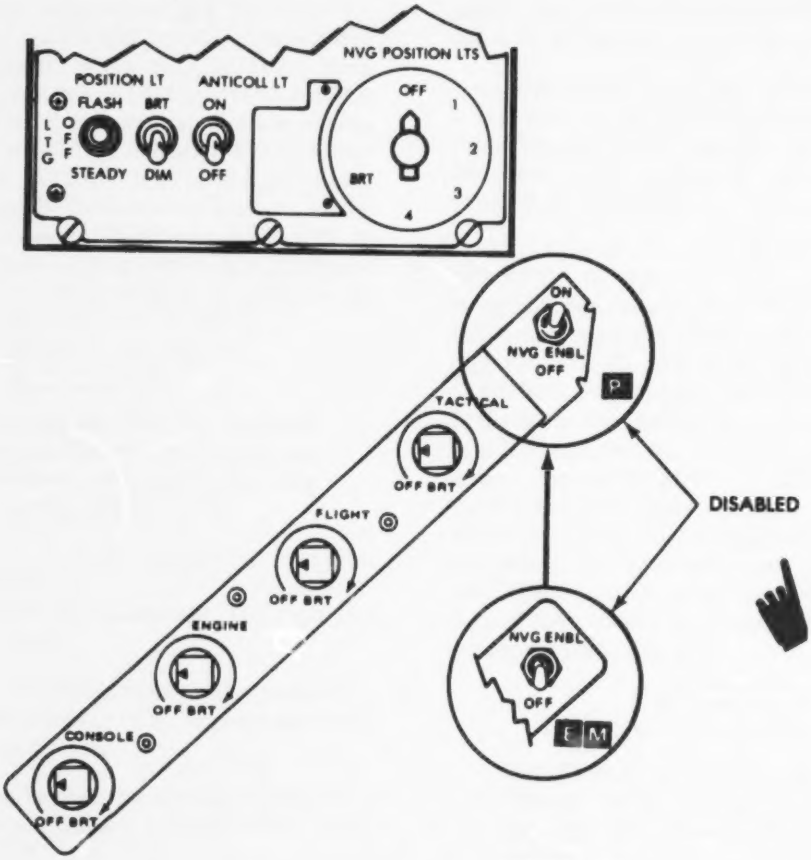

POSITION LT
FLASH
BRT
L T G
O F F
STEADY
DIM
ANTICOLL LT
ON
OFF
NVG POSITION LTS
OFF
1
2
3
4
BRT
ON
NVG ENBL
OFF
P
TACTICAL
OFF BRT
FLIGHT
OFF BRT
ENGINE
OFF BRT
CONSOLE
OFF BRT
DISABLED
NVG ENBL
OFF
E M
209075-314D

Figure 2-20. Pilot Light Control Panel

All data on page 2-40, including figure 2-21, is deleted.

c. Operation. The pilot rheostat knobs (figure 2-20) OFF position deactivates the lights. The between OFF and BRT position controls the brightness of the instruments, avionics, and control panel lights as follows:

(1) Console. RKT control panel P, ROCKETS control panel E M ARMT control panel, COMM CONT panel, miscellaneous control panel, FM radio P E, VHF AM radio M, horizontal situation indicator (HSI) control panel, left and right console, light rheostat control panel APR 39 radar warning, HUD control panel M, and reflex sight controls P E. The MASTER CAUTION, RPM and OVERTORQUE lights will dim to a preset intensity, when the CAUTION panel (BRIGHT/DIM) switch is in DIM and the CONSOLE rheostat is on. NVG compatible flip filters have been provided for the MASTER CAUTION, RPM, OVERTORQUE, FIRE, and CAUTION panel lights (figure 2-6). NVG compatible filters are also provided for the ROCKETS control panel E M (figure 4-11), APR 39 radar warning (figure 3-18) and reflex sight P E (figure 4.1-16 and 4.2-15), and the switches on the armament (ARMT) panels (figures 2-6, 2-7, and 4-17.)

WARNING

Caution/Warning flip filters are to remain in the open (unfiltered) position during day flight to insure that caution/warning lights are readily visible.

(2) Engine. Fuel quantity, engine temperature/pressure, transmission temperature/pressure, dual tachometer, TGT, volt/ammeter, N1, and torque.

(3) Flight. Airspeed indicator, attitude indicator, HSI, vertical speed indicator (VSI), pressure altimeter, radar altimeter, and clock.

(4) Tactical. Torque, pilot steering indicator (PSI) P E, low airspeed attitude indicator, HSI, radar altimeter, and clock.

NOTE

With tactical rheostat in the ON position, only the listed instruments will be illuminated.

2-68. GUNNER STATION LIGHTING.

a. General. The gunner instrument panel is illuminated by NVG compatible flood lights. The armament control panel, (figure 4-17) is illuminated by an NVG compatible edgelit panel. The magnetic compass (figure 2-5) is illuminated by one post light. The lights are powered by the dc essential bus and protected by the GNR INST LT circuit breaker.

b. Night Vision Feature. NVG compatibility is provided by using blue-green lighting, in various configurations, to illuminate instruments, avionics and control panels. The LT NORMAL/NVG switch (figure 2-11) and LTS switch (figure 2-13) have been disabled.

c. Operation. The gunner rheostat knobs (figure 2-7) P and 2-11 E M) OFF position deactivates the lights. The between OFF and BRT positions control the brightness of the instrument, avionics, and control panels lights as follows:

(1) Console. CSL LTS P CSL LT E M, WING STORES JETTISON and EMER HYDR pump/boresight control panel, PROXIMITY WARNING control panel P, COMM CONT Panel, VHF radio P E, FM radio M, ARM STBY P, and doppler NAV CONTROL PANEL M. The MASTER CAUTION light will dim when the caution panel (BRT/DIM) switch is in DIM and the CSL LTS P CSL LT E M rheostat is on. Doppler MEM/MAL, ARMED/STBY, and PILOT IN CONT lights will dim to a preset intensity when CSL LTS P CSL LT E M rheostat is on. A NVG compatible flip filter has been provided for the MASTER CAUTION panel lights (figure 2-7), and the doppler NAV control panel displays (figure 3-15) have permanant filters installed.

WARNING

Flip filters are to remain in the open (unfiltered) position during day flight to insure that the caution lights are readily visible.

(2) Instrument. INST LTS P INST LT E M : Airspeed indicator, attitude indicator, pressure altimeter, vertical speed indicator (VSI), radio magnetic indicator (RMI), P F dual tachometer, TGT, N1, torque and standby compass.

(3) **Armament Consoles.** TCP P ARMT LT E M : TOW control panel (TCP), and armament control panel.

SECTION XIII. FLIGHT INSTRUMENTS

2-69. AIRSPEED INDICATORS.

The pilot and gunner airspeed indicators (figures 2-6 and 2-7) display the helicopter indicated airspeed (IAS) in knots. The IAS is obtained by measuring the difference between impact air pressure from the pitot tube (figure 2-1) and the static air pressure from the static ports (figure 2-1). IAS is inaccurate due to instrument and installation errors.

NOTE

IAS below approximately 25 KIAS is inaccurate due to rotor downwash.

2-70. LOW AIRSPEED INDICATOR (LAI) M

The low airspeed indicator, located in the pilot instrument panel, measures and displays low airspeed up to 50 knots by horizontal (fore-aft) and vertical (lateral) direction indicators. Airspeed is sensed by the airspeed and direction sensor. The intersection of the two direction indicators is related to the circular scale to obtain resultant airspeed. A three position flag is used to indicate system operational, system failure or an overrange condition. The primary purpose is to provide windspeed to the FCC. Disregard forward airspeed indication when O/R flag is displayed. Refer to figure 2-22 for airspeed examples and flag indications.

2-71. PRESSURE ALTIMETERS.

The pilot and gunner altimeters (figures 2-6 and 2-7) display the helicopter height above sea level in feet. The altimeters are supplied power by the dc essential bus and protected by the ALTM circuit breaker. The altimeter does not provide altitude reporting.

2-72. VERTICAL SPEED INDICATOR.

The pilot and gunner vertical speed indicator (figures 2-6 and 2-7) displays the helicopter ascent and descent speed in feet per minute. The indicator is actuated by the rate of atmospheric pressure change.

2-73. FREE AIR TEMPERATURE (FAT) INDICATOR.

The pilot FAT indicator (figure 2-6) displays the outside air temperature in degrees celsius.

2-74. MAGNETIC (STANDBY) COMPASS.

The magnetic compass (figure 2-7) displays the magnetic heading of the helicopter. A compass correction card is attached to the compass.

2-75. RADIO AIDS TO NAVIGATION.

The FM radio, automatic direction finder, course indicator, and radio magnetic indicator are radio aids to navigation and are covered in Chapter 3.

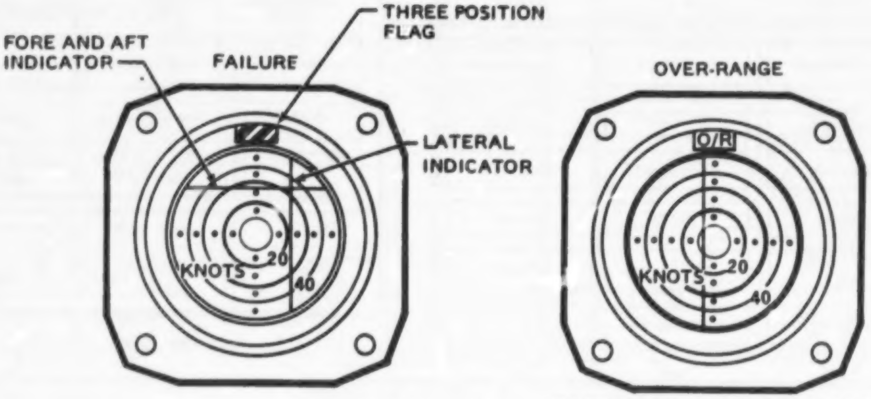
2-76. MASTER CAUTION SYSTEM.

a. **Master Caution Lights.** The pilot and gunner MASTER CAUTION lights (figure 2-23) illuminate when a caution panel light illuminates. This illumination alerts the pilot and gunner to check caution panels for the specific fault condition.

b. **Caution Panels (figure 2-23.)**

(1) **Caution Panel Lights.** The pilot and gunner caution panels lights illuminate to identify specific fault conditions. The caution light lettering is readable only when the light illuminates. The light will remain illuminated until the fault condition is corrected.

(2) **Test/Reset and Test Switches.** The pilot caution panel has a TEST/RESET toggle switch. The gunner caution panel has a TEST switch. Momentarily placing the pilot switch to the test position will cause pilot caution panel and MASTER CAUTION lights in both pilot's and gunner's station to illuminate. Pressing the gunner's test switch will cause gunner's caution panel to illuminate. Testing of the system will not change the existing fault condition indications. Momentarily placing the pilot switch in the RESET position will


FAILURE

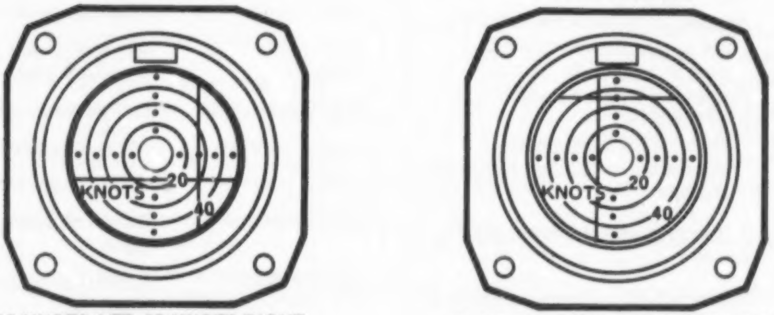
OVER-RANGE

THREE POSITION FLAG
FORE AND AFT INDICATOR
LATERAL INDICATOR
KNOTS
20
40
O/R

FORWARD AIRSPEED GREATER THAN 50 KNOTS, 5 KNOTS LEFT

OPERATIONAL

OPERATIONAL



15 KNOTS AFT, 25 KNOTS RIGHT

35 KNOTS FORWARD, 10 KNOTS LEFT

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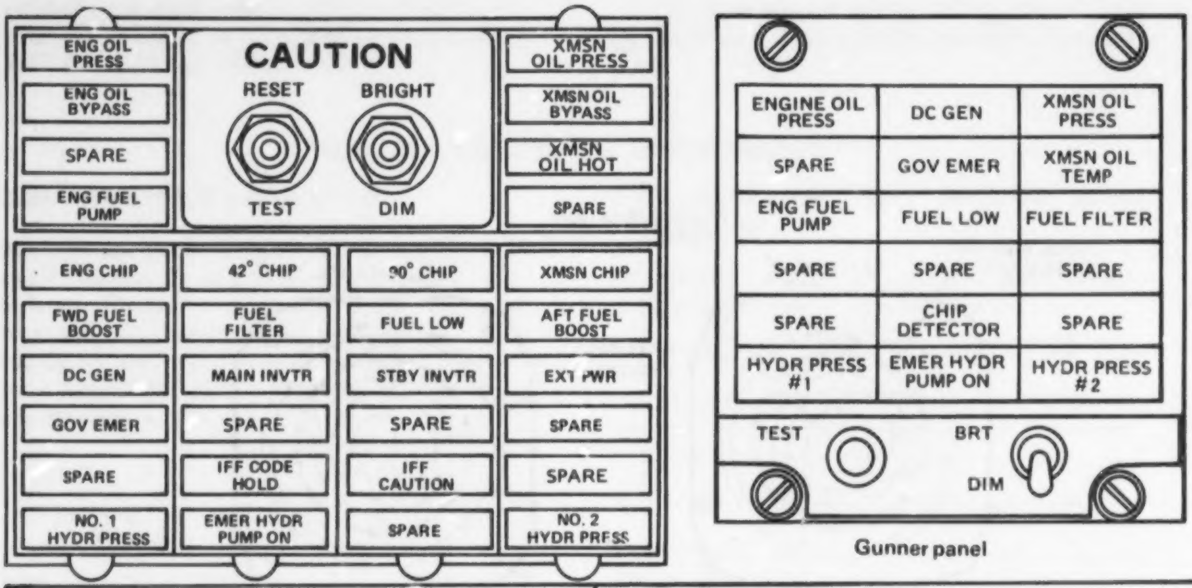
M Figure 2-22. Low Airspeed Indicator (LAI)

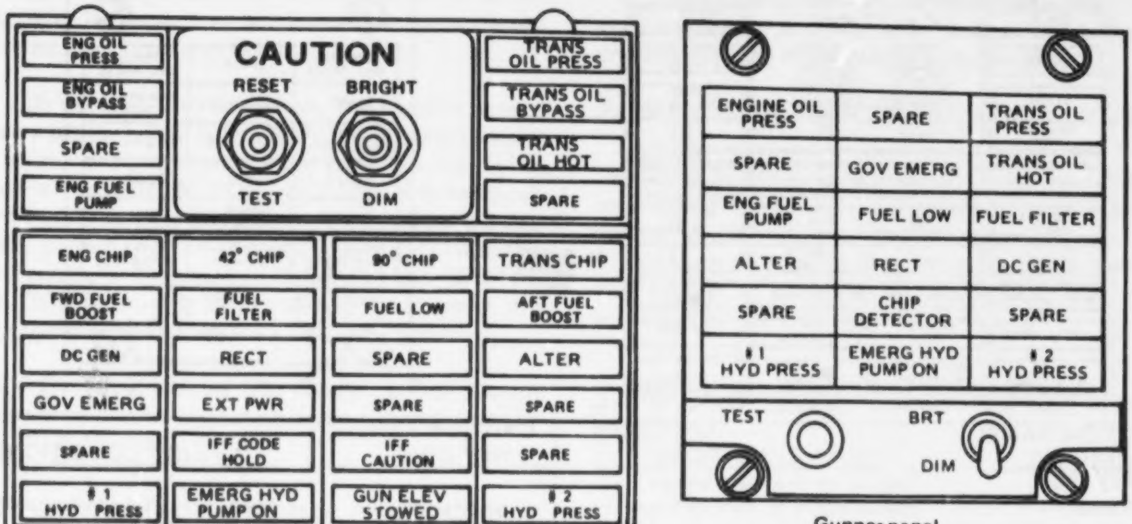

ENG OIL PRESS
CAUTION
RESET
BRIGHT
TEST
DIM
XMSN OIL PRESS
ENG OIL BYPASS
XMSN OIL BYPASS
SPARE
XMSN OIL HOT
ENG FUEL PUMP
SPARE
ENG CHIP
42° CHIP
90° CHIP
XMSN CHIP
FWD FUEL BOOST
FUEL FILTER
FUEL LOW
AFT FUEL BOOST
DC GEN
MAIN INVTR
STBY INVTR
EXT PWR
GOV EMER
SPARE
SPARE
SPARE
SPARE
IFF CODE HOLD
IFF CAUTION
SPARE
NO. 1 HYDR PRESS
EMER HYDR PUMP ON
SPARE
NO. 2 HYDR PRESS
ENGINE OIL PRESS
DC GEN
XMSN OIL PRESS
SPARE
GOV EMER
XMSN OIL TEMP
ENG FUEL PUMP
FUEL LOW
FUEL FILTER
SPARE
SPARE
SPARE
SPARE
CHIP DETECTOR
SPARE
HYDR PRESS #1
EMER HYDR PUMP ON
HYDR PRESS #2
TEST
BRT
DIM
Gunner panel

CAUTION PANEL WORDING	FAULT CONDITIONS
ENG OIL PRESS/ENGINE OIL PRESS	Engine oil pressure below operating minimum (25 psi).
XMSN OIL PRESS	Transmission oil pressure is below minimum (below 30 psi).
* ENG OIL BYPASS	Engine oil bypass switch OFF — Oil system level down 3.8 quarts from full. Engine oil bypass switch AUTOMATIC — Oil system level down 3.8 quarts from full and bypassing cooler.
* XMSN OIL BYPASS	Transmission oil bypassing oil cooler.
XMSN OIL HOT/XMSN OIL TEMP	Transmission oil temperature is at or above red line.
ENG FUEL PUMP	One side and/or both sides of engine fuel pump producing low pressure.
* ENG CHIP	Metal particles in engine.
* 42° CHIP	Metal particles in 42 degree gearbox.
* 90° CHIP	Metal particles in 90 degree gearbox.
* XMSN CHIP	Metal particles in transmission.
* FWD FUEL BOOST	Forward fuel boost pump pressure low (below 5 psi).
FUEL FILTER	Fuel filter is partially obstructed.
FUEL LOW	Low fuel quantity.
* AFT FUEL BOOST	Aft fuel boost pump pressure low (below 5 psi).
DC GEN	DC generator has failed.
* MAIN INVTR	Main inverter has failed.
* STBY INVTR	Standby inverter has failed.
* EXT PWR	External power receptacle door open.
GOV EMER	Governor switch in emergency position.
* IFF CODE HOLD	Code hold switch in the hold position.
* IFF CAUTION	IFF system inoperative.
HYD PRESS #1	System 1 hydraulic pressure is low.
EMER HYDR PUMP ON	Emergency hydraulic pump is operating.
HYD PRESS #2	System 2 hydraulic pressure is low.
**CHIP DETECTOR	Metal particles in transmission, engine, 42 degree gearbox, or 90 degree gearbox.

* Only on pilot caution panel
** Only on gunner caution panel

209075-271H

P Figure 2-23. Pilot and Gunner Caution Panels (Sheet 1 of 3)


ENG OIL PRESS
ENG OIL BYPASS
SPARE
ENG FUEL PUMP
CAUTION
RESET
BRIGHT
TEST
DIM
TRANS OIL PRESS
TRANS OIL BYPASS
TRANS OIL HOT
SPARE
ENG CHIP
42° CHIP
90° CHIP
TRANS CHIP
FWD FUEL BOOST
FUEL FILTER
FUEL LOW
AFT FUEL BOOST
DC GEN
RECT
SPARE
ALTER
GOV EMERG
EXT PWR
SPARE
SPARE
SPARE
IFF CODE HOLD
IFF CAUTION
SPARE
# 1 HYD PRESS
EMERG HYD PUMP ON
GUN ELEV STOWED
# 2 HYD PRESS
ENGINE OIL PRESS
SPARE
TRANS OIL PRESS
SPARE
GOV EMERG
TRANS OIL HOT
ENG FUEL PUMP
FUEL LOW
FUEL FILTER
ALTER
RECT
DC GEN
SPARE
CHIP DETECTOR
SPARE
# 1 HYD PRESS
EMERG HYD PUMP ON
# 2 HYD PRESS
TEST
BRT
DIM

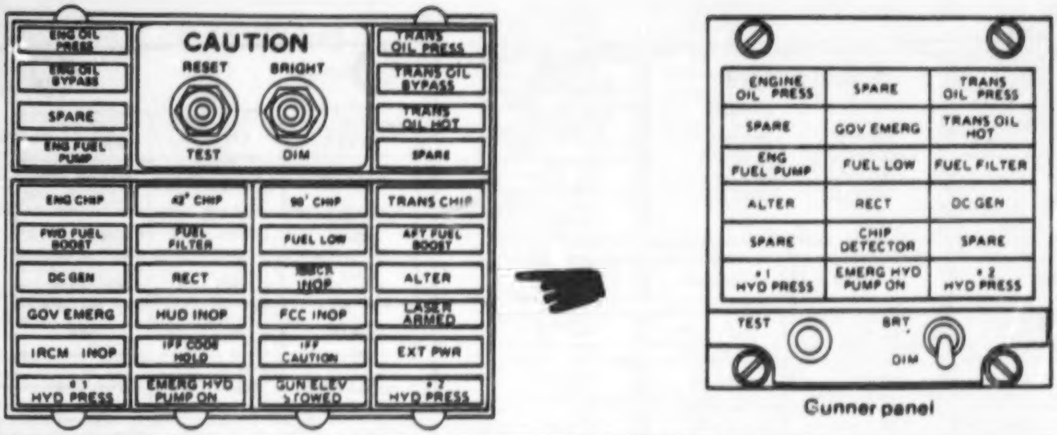
Gunner panel

CAUTION PANEL WORDING	FAULT CONDITIONS
ENG OIL PRESS	Engine oil pressure below operating minimum (25 psi).
TRANS OIL PRESS	Transmission oil pressure is below minimum (below 30 psi).
* ENG OIL BYPASS	Engine oil bypass switch OFF — Oil system level down 3.8 quarts from full. Engine oil bypass switch AUTO – Oil system level down 3.8 quarts from full and bypassing cooler.
* TRANS OIL BYPASS	Transmission oil bypassing oil cooler.
TRANS OIL HOT	Transmission oil temperature is at or above red line.
ENG FUEL PUMP	One side and/or both sides of engine fuel pump producing low pressure.
* ENG CHIP	Metal particles in engine.
* 42° CHIP	Metal particles in 42 degree gearbox.
* 90° CHIP	Metal particles in 90 degree gearbox.
* TRANS CHIP	Metal particles in transmission.
* FWD FUEL BOOST	Forward fuel boost pump pressure low (below 5 psi).
FUEL FILTER	Fuel filter is partially obstructed.
FUEL LOW	Low fuel quantity.
* AFT FUEL BOOST	Aft fuel boost pump pressure low (below 5 psi).
DC GEN	DC generator has failed or GEN switch is OFF.
RECT	Transformer rectifier unit has failed or alternator is not supplying power.
ALTER	Alternator has failed, ALTNR switch is OFF, or ROTOR RPM is below 91%.
GOV EMERG	Governor switch in emergency position.
* EXT PWR	External power receptacle door open.
* IFF CODE HOLD	Code hold switch in the hold position.
* IFF CAUTION	IFF system inoperative.
#1 HYD PRESS	System 1 hydraulic pressure is low.
EMERG HYD PUMP ON	Emergency hydraulic pump is operating.
* GUN ELEV STOWED	Turret weapon is in stowed position.
#2 HYD PRESS	System 2 hydraulic pressure is low.
**CHIP DETECTOR	Metal particles in transmission, engine, 42 degree gearbox, or 90 degree gearbox.

* Only on pilot caution panel
** Only on gunner caution panel

209075-271J

E Figure 2-23. Pilot and Gunner Caution Panels (Sheet 2 of 3)


ENG OIL PRESS
ENG OIL BYPASS
SPARE
ENG FUEL PUMP
CAUTION
RESET
BRIGHT
TEST
DIM
TRANS OIL PRESS
TRANS OIL BYPASS
TRANS OIL HOT
SPARE
ENG CHIP
42° CHIP
90° CHIP
TRANS CHIP
FWD FUEL BOOST
FUEL FILTER
FUEL LOW
AFT FUEL BOOST
DC GEN
RECT
INOP
ALTER
GOV EMERG
HUD INOP
FCC INOP
LASER ARMED
IRCM INOP
IFF CODE HOLD
IFF CAUTION
EXT PWR
# 1 HYD PRESS
EMERG HYD PUMP ON
GUN ELEV STOWED
# 2 HYD PRESS
ENGINE OIL PRESS
SPARE
TRANS OIL PRESS
SPARE
GOV EMERG
TRANS OIL HOT
ENG FUEL PUMP
FUEL LOW
FUEL FILTER
ALTER
RECT
DC GEN
SPARE
CHIP DETECTOR
SPARE
# 1 HYD PRESS
EMERG HYD PUMP ON
# 2 HYD PRESS
TEST
BRT
DIM

Gunner panel

CAUTION PANEL WORDING	FAULT CONDITIONS
ENG OIL PRESS	Engine oil pressure below operating minimum (25 psi)
TRANS OIL PRESS	Transmission oil pressure is below minimum (below 30 psi).
ENG OIL BYPASS	Engine oil bypass switch OFF — Oil system level down 3.8 quarts from full. Engine oil bypass switch AUTOMATIC — Oil system level down 3.8 quarts from full and bypassing cooler.
TRANS OIL BYPASS	Transmission oil bypassing oil cooler
TRANS OIL HOT	Transmission oil temperature is at or above red line.
ENG FUEL PUMP	One side and/or both sides of engine fuel pump producing low pressure.
ENG CHIP	Metal particles in engine.
42° CHIP	Metal particles in 42 degree gearbox.
90° CHIP	Metal particles in 90 degree gearbox.
TRANS CHIP	Metal particles in transmission.
FWD FUEL BOOST	Forward fuel boost pump pressure low (below 5 psi).
FUEL FILTER	Fuel filter is partially obstructed.
FUEL LOW	Low fuel quantity.
AFT FUEL BOOST	Aft fuel boost pump pressure low (below 5 psi).
DC GEN.	DC generator has failed or GEN switch is OFF.
RECT	Transformer rectifier unit has failed or alternator is not supplying power.
RDRCM INOP	Radar countermeasures set has failed
ALTER	Alternator has failed, ALTNR switch is OFF, or ROTOR RPM is below 91%.
GOV EMERG	Governor switch in emergency position.
*HUD INOP	Head up display has failed
*FCC INOP	Fire control computer has failed
*LASER ARMED	LASER ARM switch is in 1st or LAST position.
IRCM INOP	Provisions only
*IFF CODE HOLD	Code hold switch in the hold position.
IFF CAUTION	IFF system inoperative.
EXT PWR	External power receptacle door open.
#1 HYD PRESS	System 1 hydraulic pressure is low.
*EMERG HYD PUMP ON	Emergency hydraulic pump is operating.
*GUN ELEV STOWED	Turret weapon is in stowed position.
#2 HYD PRESS	System 2 hydraulic pressure is low.
CHIP DETECTOR	Metal particles in transmission, engine, 42 degree gearbox, or 90 degree gearbox.

*Illuminates aviation green

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M Figure 2-23. Pilot and Gunner Caution Panels (Sheet 3 of 3) extinguish and reset the pilot and gunner MASTER CAUTION lights so they will illuminate again should another fault condition occur.

(3) **Bright-Dim Switches.** The caution panels have a BRIGHT-DIM (pilot), BRT-DIM (gunner) switch to control the brightness of the panel caution lights and the MASTER CAUTION lights. This switch will not function if the pilot CONSOLE rheostat (figure 2-20) or the gunner INST LT rheostat (figure 2-11) is in the OFF position. The caution lights and the MASTER CAUTION lights will be at full brightness when the pilot/gunner rheostats are in the OFF position.

c. **Electrical Circuit.** The master caution system is powered by the dc essential bus and protected by the CAUT LT circuit breaker.

2-77. RPM HIGH-LOW LIMIT WARNING SYSTEM.

The system provides an immediate warning to check instruments for high or low rotor rpm or low engine rpm. The audio warning will be heard in the pilot and gunner headsets. The audio is a varying oscillating frequency starting low and building up to a high pitch, on for 0.85 second interval, then off for 1.25 second, then repeating cycle. The light warning and audio warning functions when the following rpm conditions exist:

Light Warning and Audio Warning in Combination or below)	For rotor rpm of 94 ± 1 percent or below (corresponds to engine rpm of 94 ± 1 percent (low warning).
Light Warning Only	For rotor rpm of 103 ± 1 percent (corresponds to engine rpm of 103 ± 1 percent) (high warning)

a. **RPM Warning Light.** The RPM light (figure 2-6) illuminates (red) to provide a visual warning of high or low rotor rpm or low engine rpm. For low rpm warning, the audio warning functions in conjunction with the light.

b. **RPM Switch — Low Audio.** The RPM WARNING switch (figure 2-10) OFF position prevents audio warning from functioning when the audio might be objectionable. The switch automatically resets to WARNING position when the engine and rotor reach normal rpm.

c. **Electrical Circuit.** The RPM high-low limit warning system is powered by dc essential bus and protected by the RPM WARN circuit breaker.

2-78. OVER TORQUE CAUTION LIGHT.

The OVER TORQUE caution light (figure 2-6) provides an immediate indication to check the torque meter for an over torque condition. The light illuminates at 100 ±0.5% torque and will extinguish at 96 ±0.5% torque. The system is powered by dc essential bus and protected by the CAUT LT circuit breaker.

2-79. ENGINE FIRE DETECTION SYSTEM.

a. **General.** The system provides the pilot with a visual indication of a fire/overheat condition in the engine compartment. The system is powered by the dc essential bus and protected by the FIRE DETR circuit breaker.

b. **Fire Detector Light.** The pilot red FIRE light (figure 2-6) illuminates when sensing elements detect excessive heat in the engine compartment. The sensing elements are attached to the tail rotor driveshaft tunnel.

c. **Fire Detector Test Switch.** Holding the pilot press-to-test FIRE DET TEST switch (figure 2-6) in the test position will cause the FIRE light to illuminate. This illumination indicates that the system is operational.

2-80. PILOT CHECKLIST HOLDER.

The pilot checklist holder provides storage for the checklist. The holder is located on the pilot right console.

2-81. GUNNER MAP CASE.

The gunner map case provides storage for mission required maps and charts. The case is located in the gunner right console.

2-82. NIGHT VISION GOGGLE (NVG) BAGS.

Two NVG bags are provided for storing night vision goggles. The gunner bag is located on the right bulkhead forward of the seat. The pilot bag is located to the left of the seat.

SECTION XIV. SERVICING, PARKING, AND MOORING

2-83. SERVICING.

a. **Servicing Diagram.** Refer to figure 2-24.

b. **Approved Military Fuels, Oils, Fluids and Unit Capabilities.** Refer to figure 2-25.

c. **Fuel Settling.** Settling time for AVGAS is 15 minutes per foot of tank depth and one hour per foot depth for jet (JP) fuels. Allow (JP) fuel to settle for a minimum of 3.3 hours before any fuel samples are taken.

2-84. APPROVED COMMERCIAL FUELS, OILS, AND FLUIDS.

a. **Fuels.** Refer to figure 2-26.

b. **Oils.** Refer to figure 2-27.

c. **Fluids.** Refer to figure 2-28.

2-85. TYPES AND USE OF FUELS.

a. **Fuel types.**

(1) **Standard Fuel.** JP-4 is designated as the Army standard fuel to be used in this helicopter. JP-4 contains icing inhibitor blended at the refinery. Commercial Jet B is a JP-4 type fuel; its mixture might or might not contain icing inhibitor.

(2) **Alternate Fuel.** JP-5 and JP-8 are designated as the alternate fuel to be used in this helicopter. JP-5 and JP-8 contain icing inhibitor blended at the refinery. Jet A and Jet A1 are JP-5 type fuels without icing inhibitor.

(3) **Emergency Fuel.** Aviation gasolines (MIL-G-5572) without Tricresyl Phosphate (TCP) are designated as the emergency fuels to be used in this helicopter.

b. **Use of Fuels.**

(1) No restrictions are imposed on the engine or aircraft when JP-4 is used.

(2) JP-5 and JP-8 type fuels may be added to JP-4 type fuels in any quanity in the helicopter fuel tank.

(3) Aviation gasoline may also be added to turbine engine fuels in any quantity in the aircraft fuel tank. A fuel mixture which contains over 10 percent leaded gasoline shall be recorded as all leaded gasoline on DA Form 2408-13.

2-86. FUEL SYSTEM SERVICING.

WARNING

Servicing personnel shall comply with all safety precautions and procedures specified in FM 10-68 Aircraft Refueling field manual.

WARNING

Infrared countermeasure set must be shut down at least one minute prior to any refueling operation and may not be restarted or originally started until the aircraft is in motion.

CAUTION

Insure that servicing unit pressure is not above 125 psi while refueling.

a. Refer to figure 2-25 for tank capacities.

b. Refer to figure 2-26 for approved fuel.

c. The helicopter may be serviced by any of the methods described as follows:

(1) **Closed Circuit Refueling (Power Off).**

(a) Refer to figure 2-24 for fuel filler location.

(b) Assure fire guard is in position with fire extinguisher.

(c) Ground servicing unit to ground stake.

(d) Ground servicing unit to helicopter.

(e) Ground fuel nozzle to ground receptacle located adjacent to fuel receptacle on helicopter.

(f) Remove fuel filler cap, and assure that refueling module is in locked position.

(g) Remove nozzle cap and insert nozzle into fuel receptacle and lock into position.

(h) Activate flow control handle to ON or FLOW position. Fuel flow will automatically shut off when fuel cell is full. Just prior to normal shutoff, fuel flow may cycle several times, as maximum fuel level is reached. Pin at base of nozzle will indicate when fuel flow stops.

(i) Assure that flow control handle is in OFF or NO FLOW position and remove nozzle.

(j) Replace fuel nozzle cap.

(k) Replace fuel filler cap.

(l) Disconnect fuel nozzle ground.

(m) Disconnect ground from helicopter to servicing unit.

(n) Disconnect servicing unit ground from ground stake.

(o) Return fire extinguisher to designated location.

(2) Gravity or Open-Port Refueling (Power Off).

(a) Refer to figure 2-24 for fuel filler location.

(b) Assure that fire guard is in position with fire extinguisher.

(c) Ground servicing unit to ground stake.

(d) Ground servicing unit to helicopter.

(e) Ground fuel nozzle to ground receptacle located adjacent to fuel receptacle on helicopter.

(f) Remove fuel filler cap.

(g) Using latch tool, attached to filler cap cable, open refueling module if equipped with closed circuit receptacle.

(h) Remove nozzle cap and insert nozzle into fuel receptacle.

(i) Activate flow control handle to ON or FLOW position. Fuel flow will automatically shut off when fuel cell is full.

(j) Assure that flow control handle is in OFF or NO FLOW position and remove nozzle.

(k) Replace fuel nozzle cap.

(l) Close refueling module by pulling cable until latch is in locked position, if equipped with closed circuit receptacle.

(m) Replace fuel filler cap.

(n) Disconnect fuel nozzle ground.

(o) Disconnect ground from helicopter to servicing unit.

(p) Disconnect servicing unit ground from ground stake.

(q) Return fire extinguisher to designated location.

(3) RAPID (HOT) Refueling (Closed Circuit).

(a) Before RAPID Refueling.

(1) Throttle-idle

(2) FORCE TRIM switch — FORCE TRIM.

WARNING

In case of helicopter fire, observe fire emergency procedures in Chapter 9.

(b) During RAPID Refueling. A crewmember shall observe the refueling operation (performed by authorized refueling personnel) and stand fireguard as required. One crewmember shall remain in the helicopter to monitor controls. Only emergency radio transmission should be made during RAPID refueling. Radar and infrared countermeasures equipment shall be placed in standby or turned off unless it is needed for defense of the aircraft.

(c) Use same procedures as for POWER OFF refueling.

(d) After Refueling. The pilot shall be advised by the refueling crew or other crewmember after refueling of the following:

(1) Fuel cap-secured.

(2) Grounding cables — Removed.

(4) **RAPID (HOT) GRAVITY Refueling.**

(a) Before RAPID Refueling.

(1) Throttle-idle.

(2) FORCE TRIM switch — FORCE TRIM.

WARNING

In case of helicopter fire, observe fire emergency procedures in Chapter 9.

(b) During RAPID Refueling. A crewmember shall observe the refueling operation (performed by authorized refueling personnel) and stand fireguard as required. One crewmember shall remain in the helicopter to monitor controls. Only emergency radio transmission should be made during RAPID refueling. Radar and infrared countermeasures equipment shall be placed in standby or turned off unless it is needed for defense of the aircraft.

(c) Use same procedures as for POWER OFF refueling.

WARNING

During RAPID GRAVITY Refueling, exercise extreme caution to prevent fuel splashing from fuel cell or fuel nozzle. Any fuel leakage could be extremely hazardous if ingested into engine air intake.

(d) After Refueling. The pilot shall be advised by the refueling crew or other crewmember after refueling of the following:

(1) Fuel cap — secured.

(2) Grounding cables — removed.

2-87. Deleted.

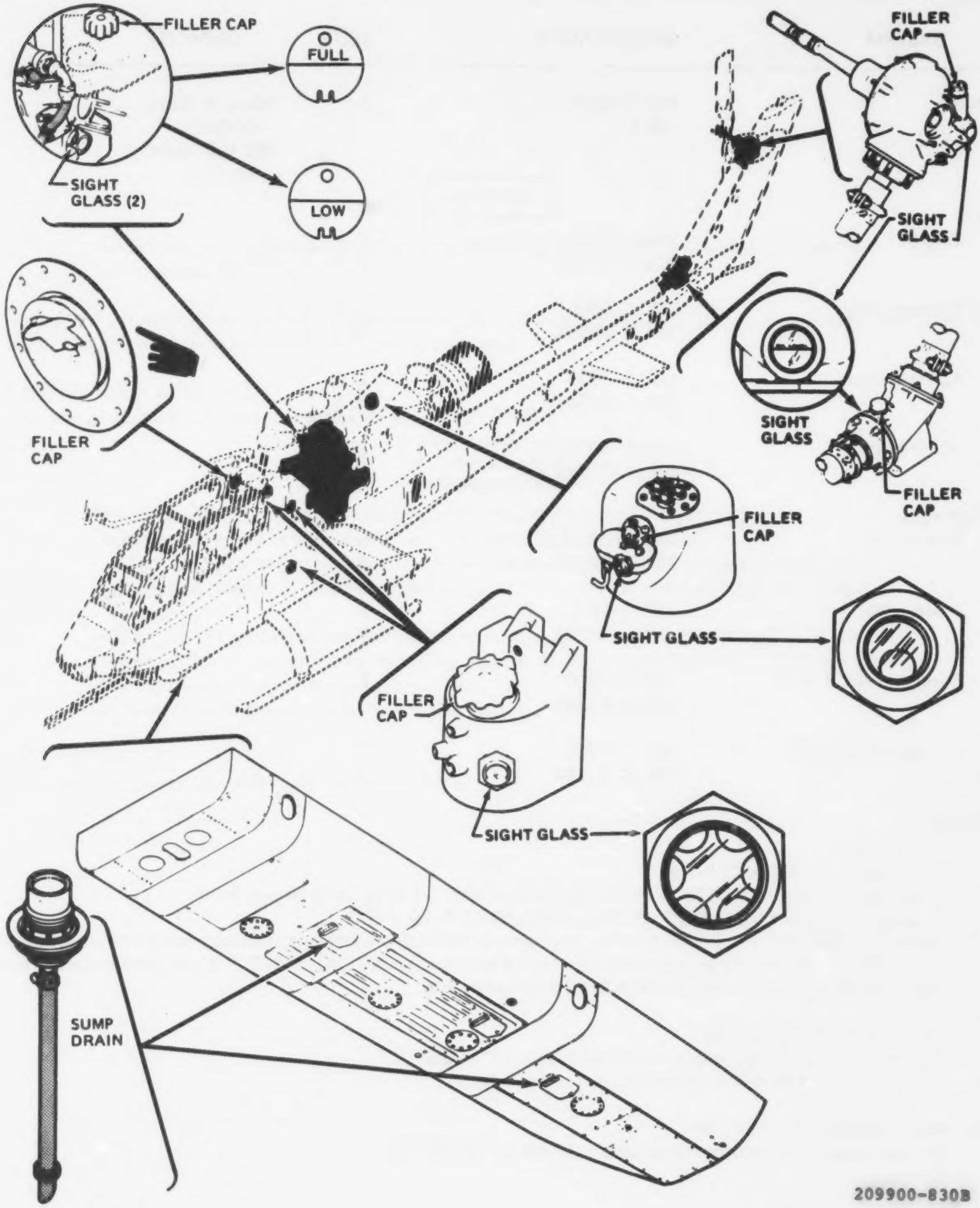

FILLER CAP
FULL
LOW
SIGHT GLASS (2)
FILLER CAP
SIGHT GLASS
SIGHT GLASS
FILLER CAP
FILLER CAP
FILLER CAP
SIGHT GLASS
FILLER CAP
SIGHT GLASS
SUMP DRAIN
209900-830B

Figure 2-24. Servicing Diagram (Typical)

SYSTEM	SPECIFICATION	NOTE	CAPACITY
Fuel	MIL-T-5624 (JP-4)	1	260 U.S. Gals. Usable 262 U.S. Gals. Total
Oil			
Engine	MIL-L-7808	2, 4	
	MIL-L-23699	3, 4	
Transmission	MIL-L-7808	2, 4	
	MIL-L-23699	3, 4	
42° Gearbox	MIL-L-7808	2, 4	
	MIL-L-23699	3, 4	
90° Gearbox	MIL-L-7808	2, 4	
	MIL-L-23699		
Hydraulic			
System No. 1	MIL-H-5606	5	
	MIL-H-83282	6	
System No. 2	MIL-H-5606	5	
	MIL-H-83282	6	
Reservoir No. 1 & 2	MIL-H-5606	5	
	MIL-H-83282		
Emergency System	MIL-H-5606	5	
	MIL-H-83282	6	

NOTE:

1. MIL-T-5624 JP-4 (NATO F-40).
   Alternate fuel is MIL-T-5624 JP-5 (NATO F-44) or MIL-T-83133 JP-8 (NATO F-34).
   Emergency fuel is MIL-G-5572 AV GAS (NATO F-12, F-18, F-22).
   The helicopter shall not be flown when the cumulative engine operating time exceeds 50 hours when AV GAS without TCP is used as emergency fuel or 25 hours when AV GAS with TCP is used as emergency fuel. Any mixture using AV GAS is considered emergency fuel.

2. MIL-L-7808 (NATO 0-148).
   For use in ambient temperatures below minus 32° C/25° F.
   May be used when MIL-L-23699 oil is not available.

3. MIL-L-23699 (NATO 0-156).
   For use in ambient temperatures above minus 32° C/25° F.

Figure 2-25. Approved Military Fuels, Oils, Fluids and Unit Capacities (Sheet 1 of 2)

CAUTION

Under no circumstances shall MIL-L-23699 oil be used in ambient temperatures below minus 32°C/25°F.

4. It is not advisable to mix MIL-L-7808 and MIL-L-23699 oils, except during an emergency: An entry on DA Form 2408-13 is required when the oils are mixed.

5. MIL-H-5606 (NATO H-515).
   For use in ambient temperatures below minus 40°C/40°F.

WARNING

When handling hydraulic fluid (MIL-H-83282), observe the following:
—Prolonged contact with liquid or mist can irritate eyes and skin.
—After any prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush them immediately with clear water.
—If liquid is swallowed, do not induce vomiting; get immediate medical attention.
—Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator.
—When fluid is decomposed by heating, toxic gases are released.

6. MIL-H-83282.
   For use in ambient temperatures above minus 40°C/40°F.

Figure 2-25. Approved Military Fuels, Oils, Fluids and Unit Capacities (Sheet 2 of 2)

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL
US MILITARY FUEL	JP-4 (MIL-T-5624)	JP-5 (MIL-T-5624) or JP-8 (MIL-T-83133)
NATO CODE NO.	F-40 (WIDE CUT TYPE)	F-44 or F-34 (High Flash Type)

COMMERCIAL FUEL (ASTM-D-1655)	JET B	JET A	JET A-1 NATO F-34
Amercian Oil Co.	Amercian JP-4	American Type A	
Atlantic Richfield	Aerojet B	Aerojet A	Aerojet A-1
Richfield Div		Richfield A	Richfield A-1
B.P. Trading	B.P.A.T.G.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A-1
Cities Service Co.		CITGO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co., USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	

FOREIGN FUEL	NATO F-40	NATO F-44
Belgium	BA-PF-2B	
Canada	3GP-22F	3-6P-24e
Denmark	JP-4 MIL-T-5624	
France	Air 3407A	
Germany (West)	VTL-9130-006	UTL-9130-007/UTL 9130-010
Greece	JP-4 MIL-T-5624	
Italy	AA-M-C-1421	AMC-143
Netherlands	JP-4 MIL-T-5624	D. Eng RD 2493
Norway	JP-4 MIL-T-5624	
Portugal	JP-4 MIL-T-5624	
Turkey	JP-4 MIL-T-5624	
United Kingdom (Britain)	D. Eng. RD 2454	D. Eng RD 2498

NOTE

Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel — The fuel system icing inhibitor shall conform to MIL-I-27686. The additive provides anti-icing protection and also functions as a biocide to kill microbial growths in helicopter fuel systems. Icing inhibitor conforming to MIL-I-27686 shall be added to commercial fuel not containing an icing inhibitor during refueling operations, regardless of ambient temperatures. Refueling operations shall be accomplished in accordance with accepted commercial procedures. This additive (prist or eq.) is not available in the Army Supply System, but will be locally procured when needed.

Figure 2-26. Approved Commercial Fuels - Equivalents for JP-4, JP-5 and JP-8

All data on page 2-52.1, including Figure 2-26.1 is deleted.

APPROVED COMMERCIAL MIL-L-7808 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	PQ Turbine Oil 8365
Humble Oil and Refining Co.	ESSO/ENCO Turbo Oil 2389
Mobile Oil Corp.	RM-201A

CAUTION

Do not use Shell Oil Co., part No. 307, qualification No. 7D-1 oil (MIL-L-7808). It can be harmful to seals made of silicone.

APPROVED COMMERCIAL MIL-L-23699 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	PQ Turbine Lubricant 6423/8878/9595
Bray Oil Co.	Brayco 899/899-S
Castrol Oil Inc.	Castrol 205
Chevron International Oil Co., Inc.	Jet Engine Oil 5
W.R. Grace and Co. (Hatco Chemical Div.)	HATCOL 3211/3611
Exxon	Turbo Oil 2380 (WS-6000)/2395 (WS-6459)
Mobil Oil Corp.	RM-139A/RM-147A/Avrex S Turbo 260/Avrex S Turbo 265
Royal Lubricants Co.	Royco 899 (C-915)/899SC
Shell Oil Co., Inc.	Aeroshell Turbine Oil 500
Standard Oil Co., of California	Chevron Jet Engine Oil 5
Stauffer Chemical Co.	Stauffer 6924/Jet II
Texaco, Inc.	SATO 7730. TL-8090

Figure 2-27. Approved Commercial Oils — Equivalents for MIL-L-7808 and MIL-L-23699 Oils

APPROVED COMMERCIAL MIL-H-5606 TYPE FLUID

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	"PO" 4226
Bray Oil Co.	Brayco 757B Brayco 756C Brayco 756D
Castrol Oils, Inc.	Hyspin A
Humble Oil and Refining Co.	Univis J41
Mobile Oil Corp.	Aero HFB
Pennsylvania Refining Co.	Petrofluid 5606B Petrofluid 4607
Royal Lubricants Co.	Royco 756C/D DS-437
Shell Oii Co.	XSL 7828
Standard Oil Co. of California	PED 3565 PED 3337
Texaco, Inc.	TL-5874
Stauffer Chemical Co.	Aero Hydroil 500
Union Carbide Chemical Co.	YT-283
Union Carbide Corp.	FP-221

Figure 2-28. Approved Commercial Fluids - Equivalents for MIL-H-5606

All data on page 2-55/2-56, including figure 2-29 is deleted.

CHAPTER 3

AVIONICS

SECTION I. GENERAL

3-1. GENERAL.

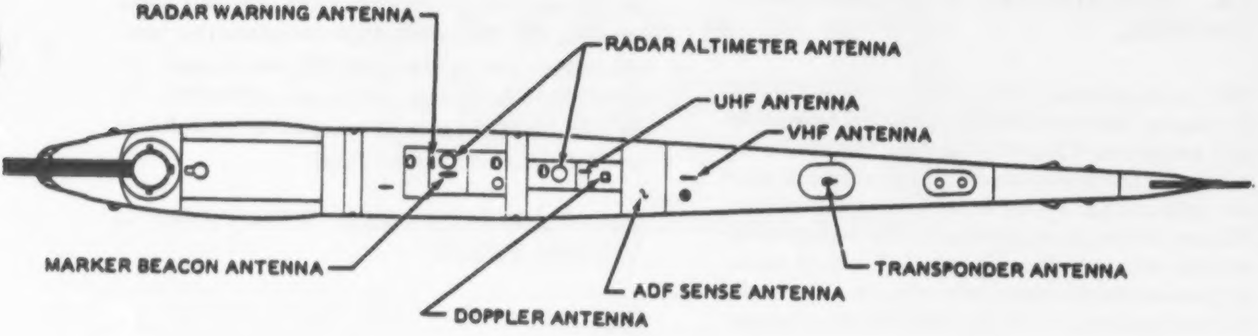
This chapter covers the electronic equipment configuration installed in Army AH–1P/E/F helicopter. It includes a brief description of the electronic equipment, its technical characteristics, and capabilities. This chapter contains complete operating instructions for all signal equipment installed in the helicopter. For mission avionics equipment, refer to Chapter 4, Mission Equipment. During equipment operation, it is assumed that the power is applied and applicable circuit breakers are energized. The terms megahertz and kilohertz are used in this chapter regardless of equipment markings.

3-2. ELECTRONIC EQUIPMENT CONFIGURATION.

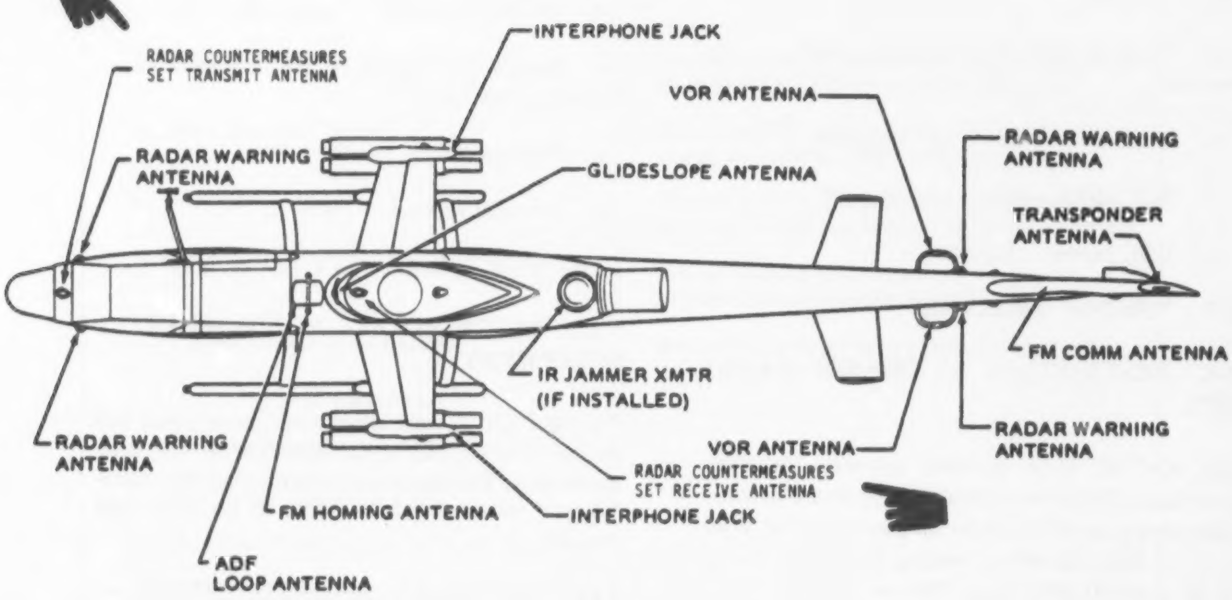
Avionics equipment installed in the helicopter with their common names, use, and operational range is presented in figure 3-1. Antenna locations are shown in figure 3-2.

NOMENCLATURE	COMMON NAME	USE	RANGE
Control, Intercommunications Set C-6533( )/AIC	Interphone Control	Interphone for pilot and gunner; integrates all communication equipment.	Stations within helicopter.
Radio Set AN/ARC-114A	VHF/FM Radio	Two way voice communication and homing.	Line of sight
Communications Security Equipment TSEC/KY-28	Voice Security Equipment	Together with the FM radio set provides secure two-way voice communications.	
Radio Set AN/ARC-115	VHF/AM Radio	Two-way voice communication.	Line of sight
Radio Set AN/ARC-116 or AN/ARC-164	UHF Radio	Two-way voice communication.	Line of sight
Horizontal Situation Indicator ID-2103/A or 209-075-660-3	HSI	Determines heading, position, and direction of flight.	
Direction Finder Set AN/ARN-89B	ADF Set	Radio range navigation.	150 to 200 miles average
Gyromagnetic Compass Set AN/ASN-43	Compass Set	Navigation aid.	
Radio Set AN/ARN-123(V)1	VOR Set	With appropriate instrumentation provided: Vhf omnirange (VOR), localizer (LOC), glideslope (GS), and marker beacon (MB) position information.	Line of sight
Transponder Set AN/APX-72 AN/APX-100	IFF Transponder Radio	Transmit a special coded reply for radar interrogator systems.	Line of sight
Radar Signal Detector Set AN/APR-39(V)1	Radar Warning Set	Provides high radar threat warning and aids evasion and mission completion.	Line of sight
Indicator, Attitude Director ID-2104/A or 209-075-661-1	ADI	Provides attitude reference and command information for the direction of flight; to include localizer, glideslope and rate-of-turn deviation indications.	Line of sight
Indicator, Radio Magnetic Compass ID-2105/A or 212-070-180-3	RMI	Provides bearing information to selected radio station relative to magnetic heading.	Line of sight
Radar Altimeter APN-209	Radar Altimeter	Provides altitude indication above terrain.	0 to 1500 ft. AGL
Navigation Set, Airborne AN/APN-128	Doppler Navigation	Provides navigation information position, bearing, time and distance to selected destination.	

Figure 3-1. Communication and Associated Electronics Equipment


RADAR WARNING ANTENNA
RADAR ALTIMETER ANTENNA
UHF ANTENNA
VHF ANTENNA
MARKER BEACON ANTENNA
TRANSPONDER ANTENNA
ADF SENSE ANTENNA
DOPPLER ANTENNA

BOTTOM VIEW


INTERPHONE JACK
RADAR COUNTERMEASURES
SET TRANSMIT ANTENNA
VOR ANTENNA
RADAR WARNING
ANTENNA
RADAR WARNING
ANTENNA
GLIDESLOPE ANTENNA
TRANSPONDER
ANTENNA
FM COMM ANTENNA
IR JAMMER XMTR
(IF INSTALLED)
RADAR WARNING
ANTENNA
RADAR WARNING
ANTENNA
VOR ANTENNA
RADAR COUNTERMEASURES
SET RECEIVE ANTENNA
FM HOMING ANTENNA
INTERPHONE JACK
ADF
LOOP ANTENNA

TOP VIEW

209900-853A

Figure 3-2. Antenna Locations (Typical)

SECTION II. COMMUNICATIONS

3-3. INTERPHONE CONTROL.

3-4. DESCRIPTION — INTERPHONE CONTROL.

This communication systems control C-6533 ( )/ARC provides an intercommunication capability between the pilot and gunner. Two of the panels are installed in the helicopter. The system is used for intercommunication and radio control. It may be used in any one of three different modes as determined by the setting of the switches and controls on the panel. The three modes of operation are: Two-way radio communication, radio receiver monitoring; and intercommunication between the pilot, gunner, and ground crews.

3-5. CONTROLS AND FUNCTIONS — INTERPHONE CONTROL.

Refer to figure 3-3.

3-6. OPERATION — INTERPHONE CONTROL.

a. Transmit interphone selector switch — As required.

b. Receivers switches — As Required.

c. HOT MIKE switch — As required.

d. VOL control - Adjust.

3-7. VHF/FM RADIO SET.

3-8. DESCRIPTION — VHF/FM RADIO SET.

The AN/ARC-114A provides two-way frequency modulated (FM) narrow band voice communications, with homing capability, in the frequency range of 30.00 to 75.95 MHz. However, homing is primarily in the 30.00 to 60.00 MHz range. The set operates on 920 channels for a distance of approximately 50 miles as limited by line of sight. A guard receiver is incorporated within the unit, with a guard frequency of 40.50 MHz. Course homing information is presented to the course deviation pointer on the Attitude Director Indicator (ADI) and course deviation bar on the Horizontal Situation Indicator (HSI). FM signal strength is presented by the guideslope deviation pointers on both the HSI and ADI, and moves up with increasing signal strength. The FM homing display is selected by means of a course select switch on the HSI control panel. The VHF/FM radio set must also be set to HOMING. The set utilizes position number 1 of the C-6533()/ARC intercommunications control panel.

3-9. CONTROLS AND FUNCTIONS — VHF/FM RADIO.

Refer to figure 3-4.

3-10. OPERATION—VHF/FM RADIO SET.

a. Function selector — As required.

b. Frequency — Select.

c. RCVR TEST switch — Press.

d. AUDIO — Adjust.

e. Interphone transmit — receiver switches — Number 1 position.

f. Transmit keying switch — Press.

g. Function selector — OFF.

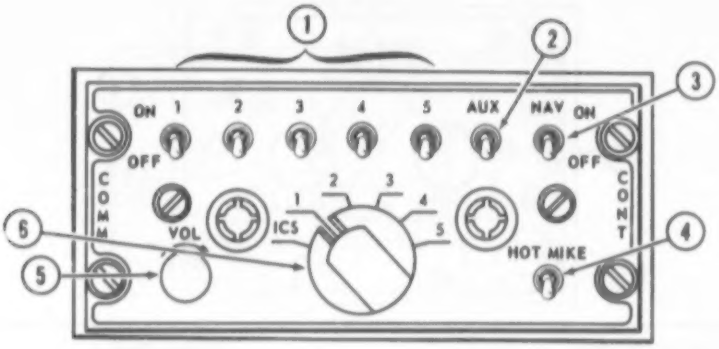
3-11. VOICE SECURITY EQUIPMENT.

3-12. DESCRIPTION — VOICE SECURITY EQUIPMENT.

The TSEC/KY-28 voice security equipment is used with the VHF/FM radio set to provide secure two-way communications. The equipment is controlled by the control-indicator mounted near the rear of the pilot right console.

3-13. CONTROLS AND FUNCTIONS — VOICE SECURITY EQUIPMENT.

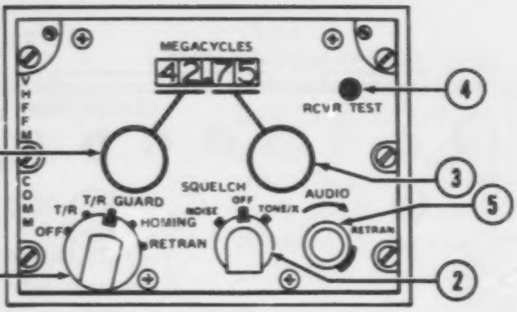
Refer to figure 3-5.



CONTROL/INDICATOR	FUNCTION
1. Receiver Switches	Connect (ON) or disconnect OFF) communications receivers from the headsets.
1 — VHF/FM ARC-114A	
2 — UHF ARC-116 or ARC-164	
3 — VHF/AM ARC-115	
4 — Not Used	
5 — Not Used	
2. AUX Receiver Switch	Connects (ON), or disconnects (OFF), VOR set receiver ARN-123(V)1 from the headset.
3. NAV Receiver Switch	Connects (ON), or disconnects (OFF), ADF navigation receiver ARN-89B from headset.
4. HOT MIKE Switch	Permits hand-free intercommunications with transmit-interphone selector in the ICS position.
5. VOL Control	Adjusts volume from receivers. Adjusts intercommunications volume.
6. Transmit-Interphone Selector	Selects transmitter to be keyed and connects microphone to transmitters.
1 — VHF/FM ARC-114A	
2 — UHF ARC-116 or ARC-164	
3 — VHF/AM ARC-115	
4 — Not Used	
5 — Not Used	
ICS	Connects the microphone to the intercommunications system only, disconnecting microphone from transmitters.

204075-1008A

Figure 3-3. Interphone Control Panel C-6533/( )/ARC



CONTROL/INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver — ON; Transmitter — Standby
T/R GUARD	Guard receiver — ON; Transmitter — Standby; Receiver — ON NOTE Reception on the guard receiver is unaffected by frequencies selected for normal communications. NOTE The guard frequency can be selected on the main receiver.
HOMING	Activates the homing mode and displays on attitude indicator. May also be used for normal voice communications. The communications antenna is automatically selected when the transmitter is keyed.
RETRAN	Retransmission may be accomplished when the second FM radio set is installed.
2. Squelch Selector	
NOISE	Eliminates background noise in headsets.
OFF	Deactivates squelch.
TONE/X	Squelches background noise in headsets.
3. Fruquency Selectors — Indicator	
Left	Selects first two digits of desired frequency.
Right	Selects third and fourth digits of desired frequency.
4. RCVR TEST Switch	When pressed, audible tone indicates proper receiver performance.
5. AUDIO Control	Adjust receiver volume.

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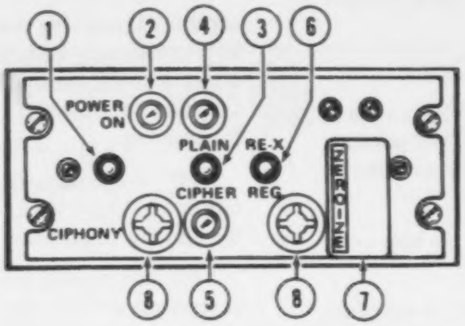
Figure 3-4. VHF/FM Radio Set AN/ARC-114A



CONTROL/ INDICATOR	FUNCTION	CONTROL/ INDICATOR	FUNCTION
1. POWER ON Switch Two Position Circuit Breaker	Connects power to the associated TSEC/KY-28 cipher equipment in the ON (forward) position, and disconnects power from the equipment in the OFF (aft) position. NOTE Switch must be in the ON (forward) position for operation in the PLAIN or CIPHER mode.	6. RE-X-REG Switch (Two-Position Locking Toggle)	In the RE-X position, permits ciphered communications through a retransmission unit (at a distant location). In the REG position, permits normal ciphered communications or clear text.
2. POWER ON Amber Indicator (With Dimmer Switch)	Lights when the associated POWER ON switch is placed in the ON (forward) position.	7. ZEROIZE Switch (Two-Position Locking Toggle, Under Spring-Loaded Cover)	Normally in OFF (aft) position. Placed in ON (forward) position during emergency situations to neutralize and make inoperative the associated TSEC/KY-28 cipher equipment. Do not place the ZEROIZE switch in the ON (forward) position unless a crash or capture is imminent.
3. PLAIN CIPHER Switch (Two-Position Locking Toggle)	In the PLAIN position, permits normal (unciphered) communications on the associated FM radio set. In the CIPHER position, permits ciphered communications on the associated radio set.	8. Panel Lights	Illuminate the control-indicator (controlled by aircraft panel lights).
4. PLAIN (Red) Indicator (with Dimmer Switch)	Lights when the associated PLAIN-CIPHER switch is in the PLAIN position.		
5. CIPHER (Green) Indicator (with Dimmer Switch)	Lights when the associated PLAIN-CIPHER switch is in the CIPHER position.		

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Figure 3-5. Voice Security Equipment — TSEC/KY-28

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3-14. OPERATION - VOICE SECURITY EQUIPMENT.

a. Preliminary.

(1) Set the control indicator POWER switch to ON. The POWER switch must be in the ON position, regardless of the mode of operation, whenever the indicator is installed.

(2) VHF/FM radio set function switch — as required.

(3) When power is initially applied, an automatic alarm procedure is initiated.

(a) A constant tone is heard in the headset and after approximately two seconds the constant tone will change to an interrupted tone.

(b) To clear the interrupted tone, press and release the transmit keying switch, the interrupted tone will no longer be heard, and the circuit will be in a standby condition ready for either transmission or reception. No traffic will be passed if the interrupted tone is still heard after pressing and releasing the transmit keying switch.

(4) PLAIN-CIPHER switch — As required.

b. Plain Mode.

(1) PLAIN-CIPHER switch — PLAIN (indicated by red light).

(2) RE-X-REG switch — REG; except when operating with retransmission units, at which time switch will be placed in the RE-X position.

(3) Transmit keying switch — Press. Speak into the microphone to transmit. Release the transmit keying switch for reception.

c. Cipher Mode.

(1) PLAIN-CIPHER switch — CIPHER (indicated by a green light).

(2) RE-X-REG switch — REG. except when operating with retransmission units, at which time switch will be placed in RE-X position.

(3) Transmit keying switch — Press. DO NOT TALK; in approximately one-half second, a beep will be heard. This indicates the receiving station is now capable of receiving your message. Transmission can now commence. Only one voice security system can transmit on a given frequency. Always listen before attempting to transmit to assure that no one else is transmitting.

(4) When transmission is completed, release the transmit keying switch. This will return equipment to the standby condition.

(5) To receive, it is necessary for another station to send you a signal first. Upon receipt of a signal, the cipher equipment will be switched automatically to the receive condition, which will be indicated by a short beep heard in the headset. Reception will then be possible. Upon loss of the signal, the cipher equipment will be automatically returned to the standby condition.

3-14.1. VOICE SECURITY EQUIPMENT TSEC/KY-58.

3-14.2. DESCRIPTION - VOICE SECURITY EQUIPMENT TSEC/KY-58.

The voice security equipment is used with the FM Command Radio to provide secure two way communication. The equipment is controlled by the controll-indicator (Z-AHP). The POWER switch must be in the ON position, regardless of the mode of operation, whenever the equipment is installed.

3-14.3. CONTROLS AND FUNCTIONS - VOICE SECURITY EQUIPMENT TSEC/KY-58.

Refer to Figure 3-5.1.

3-14.4. OPERATING PROCEDURES - SECURE VOICE.

To talk in secure voice, the KY-58 must be "Loading" with any number of desired variables.

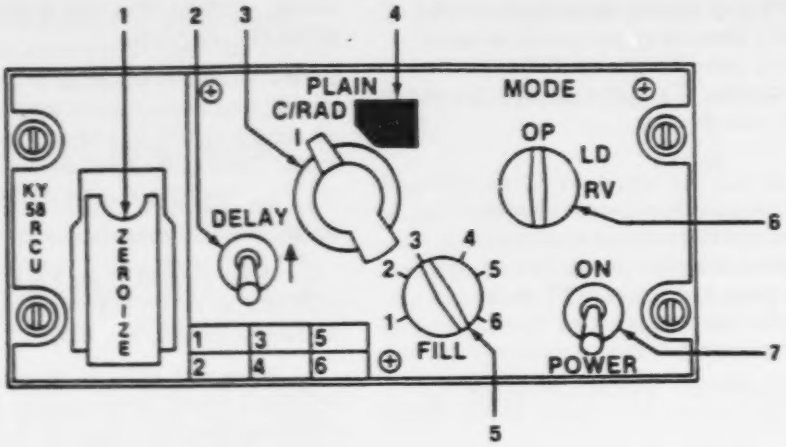
a. Set the MODE switch to OP.

b. Set the FILL switch to the storage register which contains the crypto-net variable (CNV) you desire.

c. Set the POWER switch to ON.

d. Set the PLAIN C/RAD switch to C/RAD.

e. If the signal is to be retransmitted, set the DELAY switch to ON.



CONTROL/INDICATOR	FUNCTION
1. ZEROIZE switch (two-position) momentary toggle, under spring loaded cover	Zeroize the KY-58; clears any encoding in the system
2. DELAY switch 2 position toggle	Used when signal is to be retransmitted.
3. PLAIN-C/RAD1 Switch rotary 2 position selector switch	In the PLAIN position, permits normal (unciphered) communications on the associated FM radio set. In the C/RAD1 position, permits ciphered communications on the associated radio set.
4. N/A	
5. FILL switch 6 position rotary switch	Permits pilot to select one of 6 storage registers for filling.
6. MODE Switch three position rotary	In the OP position KY-58 normal operating. In the LD position for filling. In the RV position KY-58 in Receive-Variable. Filled from another external source.
7. POWER ON switch two position toggle	Connects power to the associated TSEC/KY-58 cipher equipment in the ON (forward) position, and disconnects power from the equipment in the OFF (aft) position. Turns on power to TSEC/KY-58.

Figure 3-5.1. Voice Security Equipment T/SEC KY-58

f. At this time a crypto alarm and background noise in the aircraft audio intercom system should be heard. To clear this alarm, press and release PTT in the aircraft audio/intercom system. Secure voice communication is now possible.

NOTE

When operating in either secure or clear (plain) voice operations the aircraft audio intercom system should be heard. To clear this alarm, press and release PTT in the aircraft audio/intercom system. Secure voice communication is now possible.

3-14.5. OPERATING PROCEDURES — CLEAR VOICE.

a. Set the RCU PLAIN-C/RAD 1 switch to PLAIN.

b. Operate the equipment.

3-14.6. OPERATING PROCEDURES — ZEROING.

Instructions should orginate from the Net Controller or Commander as to when to zeroize the equipment and power must be on.

a. Lift the red ZEROIZE switch cover on the RCU.

b. Lift the spring-loaded ZEROIZE switch. This will zeroize positions 1-6.

c. Close the red cover.

3-14.7. OPERATING PROCEDURES - AUTOMATIC REMOTE KEYING.

Automatic Remote Keying (AK) causes an "old" crypto-net variable (CNV) to be replaced by a "new" CNV. Net Controller simply transmits the "new" CNV to your KY-58.

a. The Net Controller will use a secure voice channel with directions to stand by for an AK transmission. Calls must not be made during this standby action.

b. Several beeps should now be heard in headset. This means that the "old" CNV is being replaced by a "new" CNV.

c. Using this "new" CNV, the Net Controller will ask for a "radio check."

d. After the "radio check" is completed, the Net Controller instructions will be to resume normal communications. No action should be taken until the net controller requests a "radio check."

3-14.8. OPERATING PROCEDURES - MANUAL REMOTE KEYING.

The Net Controller will make contact on a secure voice channel with instructions to stand by for a new crypto-net variable (CNV) by a Manual Remote Keying (MK) action. Upon instructions from the controller:

a. Set the RCU FILL switch to position 6. Notify the Net Controller by radio, and stand by.

b. When notified by the Net Controller, set the Z-AHP MODE switch to RV (receive variable). Notify the Net Controller, and stand by.

c. When notified by the Net Controller, set the Z-AHP FILL switch to any storage position selected to receive the new CNV (may be unused or may contain the variable being replaced). Notify the Net Controller, and stand by.

NOTE

When performing Step c. the storage position (1 through 6) selected to receive the new CNV may be unused, or it may contain the variable which is being replaced.

d. When notified by Net Controller, listen for a beep in headset, wait two seconds and set the RCU MODE switch to OP. Confirm if:

(1) The MK operation was successful, the Net Controller will now contact you via the new CNV.

(2) The MK operation was not successful, the Net Controller will contact you via clear voice (plain) transmission; with instructions to set your Z-AHP FILL selector switch to position 6, and stand by while the MK operation is repeated.

3-14.9 KY-58 AUDIO TONES - NORMAL AND EQUIPMENT MALFUNCTION.

a. Continous beeping, with background noise, is cryptoalarm. This occurs when power is first applied to the KY-58, or when the KY-58 is zeroized. This beeping is part of normal KY-58 operation. To clear this tone, press and release the PTT button on the Z-AHQ after the Z-AHQ LOCAL switch has been pressed. Also the PTT can be pressed in the cockpit.

b. Background noise indicates that the KY-58 is working properly. This noise should occur at TURN ON of the KY-58, and also when the KY-58 is generating a cryptovariable. If the background noise is not heard at TURN ON, the equipment must be checked out by maintenance personnel.

c. Continous tone could indicate a "parity alarm." This will occur whenever an empty storage register is selected while holding the PTT button in. This tone can mean any of three conditions:

(1) Selection of any empty storage register.

(2) A "bad" cryptovariable is present.

(3) Equipment failure has occured. To clear this tone, follow the "Loading Procedures" in TM 11-5810-262-OP. If this tone continues, have the equipment checked out by maintenance personnel.

d. Continuous tone could also indicate a cryptoalarm. If this tone occurs at any time other than in Step c above, equipment failure may have occurred. To clear this tone, repeat the "Loading Procedures" in TM 11-5810-262-OP. If this tone continues, have the equipment checked out by the maintenance personnel.

e. Single beep, when RCU is not in TD (Time Delay), can indicate any of three normal conditions:

(1) Each time the PTT button is pressed when the KY-58 is in C (cipher) and a filled storage registr is selected, this tone will be heard. Normal use (speaking) of the KY-58 is possible.

(2) When the KY-58 has successfully received a cryptovariable, this tone indicates that a "good" cryptovariable is present in the selected register.

(3) When you begin to receive a ciphered message, this tone indicates that the cryptovariable has passed the "parity" check, and that it is a good variable.

f. A single beep, when the RCU is in TD (Time Delay) occuring after the "preamble" is sent, indicates that you may begin speaking.

g. A single beep, followed by a burst of noise after which exists a seemingly "dead" condition indicates that your receiver is on a different variable than the distant transmitter. If this tone occurs when in cipher text mode: Turn RCU FILL switch to the CNV and contact the transmitter in PLAIN text and agree to meet on a particular variable.

3-15. VHF/AM RADIO SET.

3-16. DESCRIPTION — VHF/AM RADIO SET.

The AN/ARC-115 Radio Set provides amplitude — modulated (AM) narrow band voice communications with the frequency range of 116.000 to 149.95 MHz on 1360 channels. The set is effective at a distance of approximately 50 miles, line of sight. A guard receiver is incorporated with the unit, which is fixed tuned to 121.500 MHz. The radio set control panel is labeled VHF/AM COMM and utilizes position 3 of the C-6533( )/ARC interphone control panel.

3-17. CONTROLS AND FUNCTIONS — VHF/AM RADIO SET.

Refer to figure 3-6.

3-18. OPERATION — VHF/AM RADIO SET.

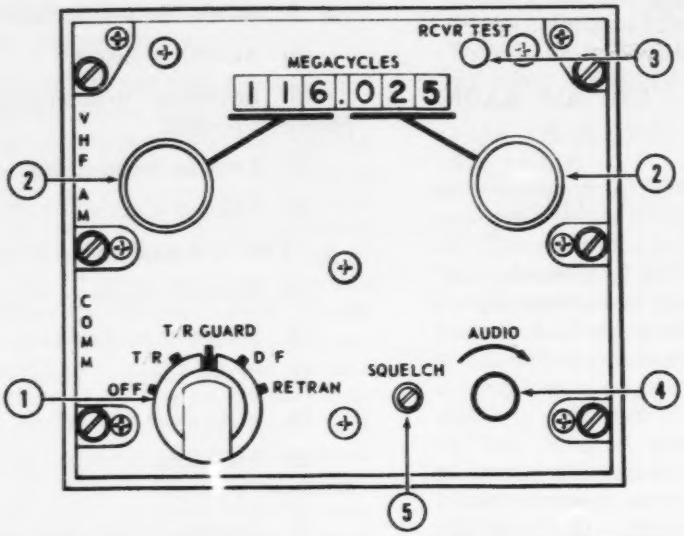
a. Function selector — As required.

b. Frequency — Select.

c. RCVR TEST — Press.

d. AUDIO — Adjust.

e. Interphone transmit-receive switches — Number 3 position.


RCVR TEST
MEGACYCLES
116.025
VHF AM COMM
T/R GUARD
T/R
D/F
OFF
RETRAN
SQUELCH
AUDIO
①
②
②
③
④
⑤

CONTROL/ INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver — On; Transmitter — Standby.
T/R GUARD	Receiver — On; Transmitter — Standby; Guard Receiver — On. NOTE Reception on guard frequency is unaffected by frequencies selected for normal communications.
D/F	Not used.
RETRAN	Not used.
2. Frequency Selectors	
Left	Selects first three digits of desired frequency.
Right	Selects fourth, fifth and sixth digits of desired frequency.
3. RCVR TEST switch	When pressed, audible signal indicates proper receiver performance.
4. AUDIO control	Adjusts receiver volume.
5. SQUELCH control	Squelch control adjusted by maintenance personnel only.

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Figure 3-6. VHF/AM Radio Set AN/ARC-115

f. Transmit keying switch — Press.

g. Function selector — OFF.

3-19. UHF/AM RADIO SET.

3-20. DESCRIPTION - UHF/AM RADIO SET.

The AN/ARC-164 (or AN/ARC-116) provides two-way UHF amplitude modulated (AM) narrow band voice communications within the frequency range of 225.00 to 399.95 MHz on 3500 channels for a distance of approximately 50 miles as limited by conditions. A guard receiver is incorporated in the set and is fixed tuned to 243.00 MHz. Both receivers are disabled during transmitter operation. The radio set control panel is marked UHF. The UHF radio transmitter and main receiver operate on the same frequency and are simultaneously tuned by frequency selector knobs on the panel. When the function selector switch is placed in the T/R GUARD (AN/ARC-116) or BOTH (AN/ARC-164) position, constant monitoring of the UHF guard frequency (243.00 MHz) is possible regardless of main receiver-transmitter frequency selected. The set utilizes selector switch (6, figure 3-3) position number 2 of the interphone control panel.

The UHF set is used for transmission and reception. The audio signal level is adjusted by the volume control and the signal is then applied to the interphone control panels for selection. When the No. 2 receiver switch is on, the audio signal lever is further adjusted by the interphone control panel volume (VOL) control and is fed to the headset. When the No. 2 transmit position is selected and the microphone output is amplified in the audio control panel and applied to the UHF command transmitter. Sidetone audio is routed back to the headset in the same way as receiver audio.

3-21. CONTROLS AND FUNCTIONS — UHF/AM RADIO SET.

Refer to figure 3-7.

3-22. OPERATION — UHF/AM RADIO SET.

a. UHF/AM Radio Set (ARC-116).

(1) Function selector — As required.

(2) Frequency — Select.

(3) RCVR TEST — Press-to-test.

(4) AUDIO — Adjust.

(5) Interphone transmit-receive switches — Number 2 position.

(6) Transmit keying switch — Press.

(7) Function selector — OFF.

b. UHF/AM Radio Set ARC-164.

(1) Function selector — As required.

(2) Frequency — Select.

(3) TONE switch — Press.

(4) VOL. control — Adjust.

(5) Interphone transmit-receive switches — Number 2 position.

(6) Transmit keying switch — Press.

(7) Function selector — OFF.

c. Channel Preset Procedure (ARC-164).

(1) UHF switch - MAIN.

(2) Mode switch — PRESET.

(3) Frequency selector switch — Set frequency.

(4) Channel selector switch - Set channel.

(5) Cover — Open.

(6) PRESET switch — Press.

(7) Cover — Close.

3-23. EMERGENCY OPERATION.

a. UHF/AM Radio Set (ARC-116). Place function selector in T/R GUARD. Select 243.00 MHz and transmit.

b. UHF/AM Radio Set (ARC-164). Place mode switch to GUARD position. Radio is ready to transmit and receive on 243.00 MHz.

3-23.1. RADIO SET AN/ARC-186 (V).

3-23.2. DESCRIPTION - RADIO SET AN/ARC-186(V). (Figure 3-7.1).

The radio set is a VHF FM-AM transceiver that provides in the clear and secure voice communication capability of frequencies in both VHF, AM and FM bands. Over a frequency range of 108.00 MHz to 115.975 MHz, Radio Set AN/ARC 186(V) functions as a receiver for the reception of amplitude-modulated (AM) transmissions. At frequencies in the range of 116.000 MHz to 151.975 MHz, the set operates both as an AM receiver and AM transmitter. From 108.000 MHz, to 151.975 MHz, a total of 1790 AM voice communication channels spaced at 25 KHz, are provided by the set. In a range of frequencies extended from 30.000 MHz to 87.975 MHz, Radio Set AN/ARC-186(V) functions both as an FM receiver and FM transmitter. Operating in this frequency range, Radio Set AN/ARC-186(V) provides 2320 FM voice communication channels. The channels are spaced at 25 KHz. Radio Set AN/ARC-186(V) also provides 20-channel presets which can be any combination of AM or FM frequencies. Automatic tuning to both AM and FM emergency frequencies (121.5 MHz and 40.5 MHz, respectively) is provided by setting only one control. Power output of the transmitter section of the transceiver is 10 watts.

3-23.3. CONTROLS AND FUNCTIONS - RADIO SET AN/ARC-186(V).

Refer to Figure 3-7.1

3-23.4. OPERATION - CONTROL (MODE) SETTINGS.

a. TR mode: two-way in the clear and secure voice communication. Refer to paragraphs 3-18 through 3-20 for voice security system.

b. Not functional this installation.

c. EMER AM-FM mode: emergency two-way voice communication on selected guard channel.

3-23.5 OPERATION - TRANSMIT/RECEIVE (TR) MODE.

a. Set OFF-TR-D/F mode select switch to TR.

b. Set EMER AM/FM-MAN-PRE frequency selector switch to MAN for manual frequency selection or to PRE for present channel selection.

c. To manually select a frequency, rotate the four MHz selector switches until desired frequency is displayed at indicator windows.

d. To select a preset channel, rotate preset channel selector switch until the number (1 to 20) of the desired channel is displayed in preset CHAN indicator window. The radio set will automatically tune to the preset channel in both TR and DF modes.

3-23.6 OPERATION - AM EMERGENCY (EMER AM) MODE.

a. Set OFF-TR-DF mode select switch to either TR or D/F.

b. Set Emer AM/FM-MAN-PRE frequency control/emergency select switch to EMER AM. This mode will automatically disable the secure speech function and enable in the clear voice communication.

3-23.7 OPERATION - FM EMERGENCY (EMER FM) MODE.

The FM Emergency mode enables voice reception/transmission on a prestored guard frequency of 40.500 MHz.

a. Set OFF-TR-D/F mode select switch to either TR or D/F.

b. Set EMER AM/FM-MAN-PRE frequency control/emergency select switch to EMER FM. This mode will automatically disable the secure speech function and enable in the clear voice communication.

3-23.8. OPERATING PROCEDURES - RADIO SET AN/ARC-186.

a. Squelch Disable - SQ DIS/TONE switch to SQ DIS. Squelch will remain disabled (open) until switch is returned to center position.

b. Tone Transmission - SQ DIS/TONE switch to the momentary TONE position to transmit (FM or AM) tone frequency of approximately 1000 Hz. Releasing the switch disables the tone frequency.

c. Loading Preset Channels.

(1) Set OFF-TR-D/F mode select switch to TR.

(2) Set EMER AM/FM-MAN-PRE frequency control emergency select switch to MAN.

(3) Rotate the four MHz selector switches until desired frequency is displayed in indicator windows.

(4) Rotate CHAN preset channel selector switch until desired channel is displayed in the indicator window.

(5) Remove SNAP-ON-COVER.

(6) Momemtarily hold WB-NB-MEM LOAD switch to MEM LOAD. Preset frequency is now loaded into memory.

d. Wideband/Narrowband Selection.

(1) Remove SNAP-ON-COVER.

(2) For wideband operation, set WB-NB MEM LOAD switch to WB.

(3) For narrowband operation, set WB-NB-MEM switch to NB.

NOTE

This switch shall be placed in the WB position at any time the MEM LOAD function is not being accomplished. The NB position is not used in this installation.

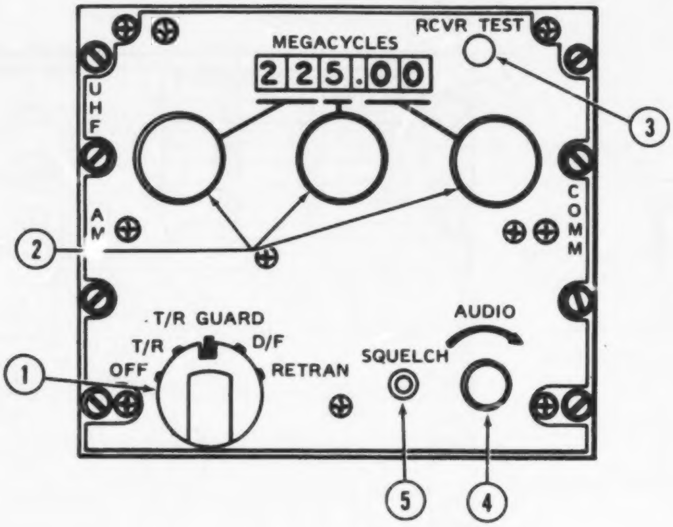
e. Band Lockout Selection.

(1) Remove SNAP-ON-COVER.

(2) Ensure LOCKOUT-FM-AM switch is in LOCKOUT position (indicated by a white dot on the switch).

NOTE

With the LOCKOUT-FM-AM switch set to AM or FM, the frequency of the band selected will be locked out. This will cause an audible warning to occur whenever a frequency in a locked out band is selected. For this installation, operational AM and FM bands are required and the LOCKOUT-AM-FM switch must be set to the LOCKOUT position.


MEGACYCLES
RCVR TEST
2 2 5 . 0 0
UHF
AM
COMM
T/R GUARD
T/R
D/F
OFF
RETRAN
SQUELCH
AUDIO
1
2
3
4
5

AN/ARC 116

CONTROL/INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver — ON; Transmitter — Standby
T/R GUARD	Receiver — ON; Transmitter — Standby; Guard Receiver — ON
D/F	Not used.
RETRAN	Not used.
2. Frequency Selectors — Indicator	
Left	Selects first two digits of desired frequency.
Middle	Selects third digit (1 MHz) of desired frequency.
Right	Selects last two digits of desired frequency.
3. RCVR TEST Switch	When pressed, audible tone indicates proper receiver performance.
4. AUDIO Control	Adjusts receiver audio volume.
5. SQUELCH Control	Squelch control adjusted by maintenance personnel only.

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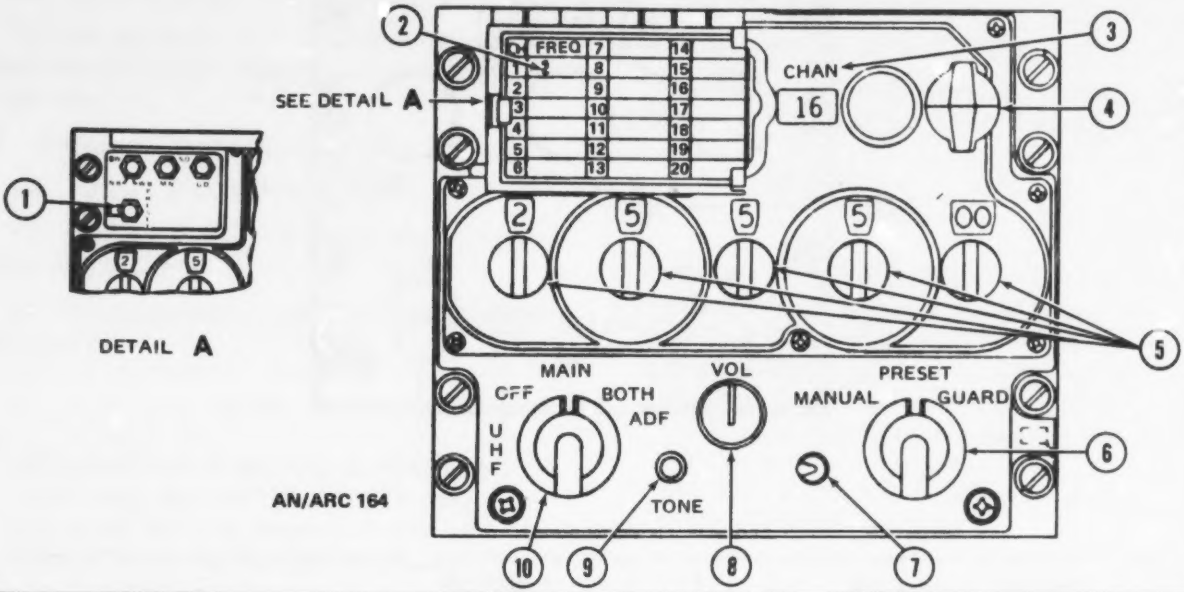
Figure 3-7. UHF/AM Radio Set (Sheet 1 of 2)


SEE DETAIL A
DETAIL A
①
②
③
④
⑤
⑥
⑦
⑧
⑨
⑩
FREQ
CHAN
16
MAIN
OFF
BOTH
ADF
UHF
VOL
PRESET
MANUAL
GUARD
TONE
AN/ARC 164

CONTROL/INDICATOR	FUNCTION
1. PRESET	Press — Sets selected frequency in desired preset channel.
2. Channel frequency card	Provides space to record selected frequency.
3. CHAN window	Indicator selected channel.
4. Channel selector knob	Selects preset channel.
5. Frequency selector	Selects desired frequency.
6. Mode selector	
MANUAL	Frequency selected with frequency selector knobs.
PRESET	Selects preset channel as desired by CHAN selector.
GUARD	Frequency is automatically positioned to guard channel (243.000 MHz).
7. SQUELCH	
OFF	Received unsquelched
ON	Received squelch operating.
8. VOL knob	Adjusts audio volume.
9. TONE pushbutton	When pressed, audible tone indicated proper receiver performance.
10. UHF knob	
OFF	Power off.
MAIN	Main receiver on, transmitter in standby.
BOTH	Main and guard receiver on, main transmitter in standby.
ADF	Not used.

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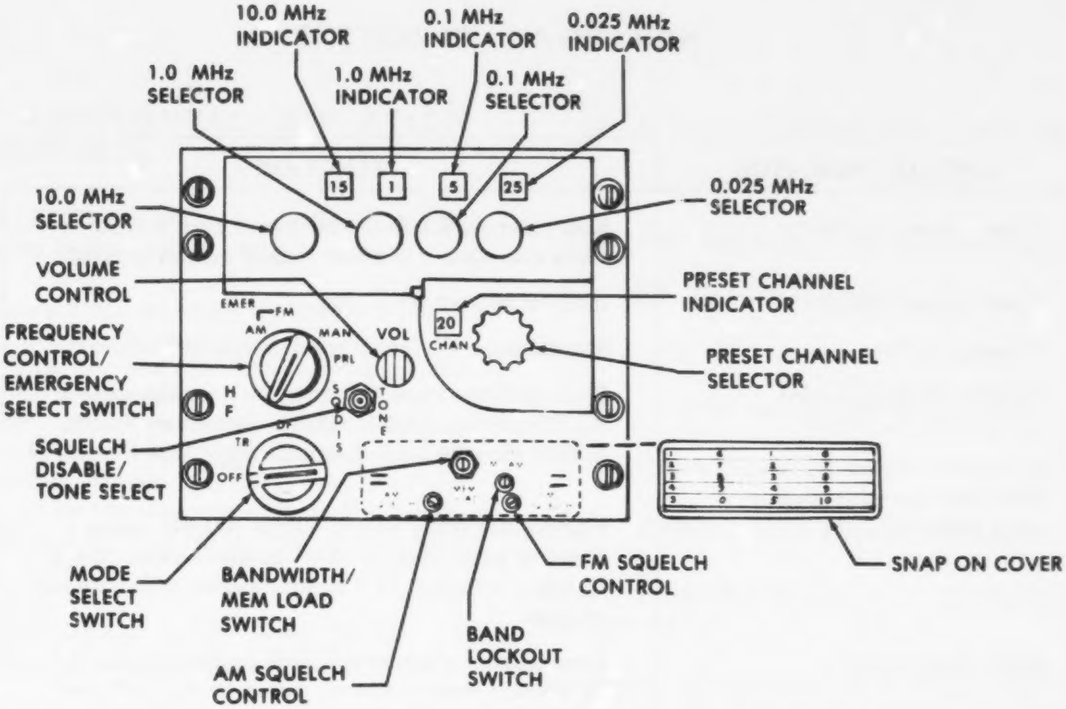
Figure 3-7. UHF/AM Radio Set (Sheet 2 of 2)


10.0 MHz INDICATOR
0.1 MHz INDICATOR
0.025 MHz INDICATOR
1.0 MHz SELECTOR
1.0 MHz INDICATOR
0.1 MHz SELECTOR
10.0 MHz SELECTOR
0.025 MHz SELECTOR
15
1
5
25
VOLUME CONTROL
PRESET CHANNEL INDICATOR
20
CHAN
EMER
FM
AM
MAN
PRL
VOL
FREQUENCY CONTROL/ EMERGENCY SELECT SWITCH
PRESET CHANNEL SELECTOR
H F
SQUELCH DISABLE/ TONE SELECT
OFF
TR
DF
MODE SELECT SWITCH
BANDWIDTH/ MEM LOAD SWITCH
FM SQUELCH CONTROL
SNAP ON COVER
BAND LOCKOUT SWITCH
AM SQUELCH CONTROL

CONTROL/INDICATOR	FUNCTION
0.025 MHz selector	Rotary switch. Selects r/t frequency in 0.025 MHz increments. Clockwise rotation increases frequency.
0.025 MHz indicator	Indicates manually selected r/t frequency in 0.025 MHz increments.
0.1 MHz selector	Rotary switch. Selects r/t frequency in 0.1 MHz increments. Clockwise rotation increases frequency.
0.1 MHz indicator.	Indicates manually selected r/t frequency in 0.1 MHz increments.
1.0 MHz selector	Rotary switch. Selects r/t frequency in 1.0 MHz increments. Clockwise rotation increases frequency.
1.0 indicator	Indicates manually selected r/t frequency in 1.0 increments.
10 MHz selector	Rotary switch. Selects r/t frequency in 10 MHz increments from 30 to 150 MHz. Clockwise rotation increases frequency.
10 MHz indicator	Indicates manually selected r/t frequency in 10 MHz increments from 30 to 150 MHz.

Figure 3-7.1 Control AN/ARC-186(V) (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
Preset channel selector	Rotary switch. Selects preset channel from 1 to 20. Clockwise rotation increases channel number selected.
Preset channel indicator	Indicates selected preset channel.
Volume control	Potentiometer. Clockwise rotation increases volume.
Squelch disable/tone select	Three-position switch. Center position enables squelch. SQ DIS position disables squelch. Momentary TONE position transmits tone of approximately 1000 Hz.
Frequency control/emergency select switch	Four-position rotary switch. EMER AM-FM selects a prestored guard channel. MAN position enables manual frequency selection. PRE position enables preset channel selection.
Mode select switch	Three-position rotary switch. OFF position disables r/t TR position enables transmit receive modes. D/F position enables FM homing.
Bandwidth/memory load switch	Three-position switch. NB position enables narrow-band selectivity. WB enables wideband selectivity in the FM band. Momentary MEM LOAD allows manually selected frequency to go into selected preset channel memory.
AM squelch control	Screwdriver adjustable potentiometer. Squelch overidden at maximum counterclockwise position. Clockwise rotation increases input signal. Required to open the squelch.
FM squelch control	Screwdriver adjustable potentiometer. Squelch overidden at maximum counterclockwise position. Clockwise rotation increases input signal required to open the squelch.
Band lockout switch	Will lock out the AM or FM frequency of the band selected. Presently set to the center (LOCKOUT) position to receive both AM and FM bands.

Figure 3-7.1. Control AN/ARC-186 (V) (Sheet 2 of 2)

SECTION III. NAVIGATION

3-24. HORIZONTAL SITUATION INDICATOR (HSI).

3-25. DESCRIPTION — HORIZONTAL SITUATION INDICATOR (HSI).

The HSI (figure 3-8) is located in the pilot instrument panel. This indicator is used in conjunction with the Direction Finder Set, VHF/FM Radio operating in the homing mode, Gyromagnetic Compass Set, the VOR-LOC-GS-MB System which supplies landing approach information and **M** Doppler NAV for range, bearing, course information. Part of the information to the HSI is controlled by the HSI Display Control Panel (figure 3-9) located in the pilot instrument panel.

3-26. CONTROLS AND FUNCTIONS — HORZONTAL SITUATION INDICATOR (HSI).

Refer to figures 3-8 and 3-9.

3-27. OPERATION — HORIZONTAL SITUATION INDICATOR (HSI).

a. **ADF Operation.**

(1) ADF frequency — As required.

(2) BRG PTR 1 or BRG PTR 2 selector knob — ADF position.

(3) HDG SEL knob — Set to desired heading.

b. **VOR/ILS/LOC Operation.**

(1) VOR frequency — As required.

(2) BRG PTR 1 or BRG PTR 2 selector knob — VOR position.

(3) COURSE switch — VOR.

(4) HDG SEL knob — Set to desired heading.

(5) CRS SEL knob — Set to desired VOR course.

c. **FM Homing Operation.**

(1) FM frequency — As required.

(2) FM function selector knob — HOMING.

(3) COURSE switch — FM HOME.

(4) HDG SEL knob — Set to desired heading.

d. **M** **Doppler Operation.**

(1) BRG PTR 1 selector knob — DPLR.

(2) COURSE switch — DPLR position.

(3) Follow Doppler Operation, paragraph 3-44.

3-28. DIRECTION FINDER SET.

3-29. DESCRIPTION — DIRECTION FINDER SET.

The Direction Finder Set (ADF) RCVR AN/ARN-89B, located in the pilot right console, is used in conjunction with the VOR/LOC, gyromagnetic compass, and intercommunications systems. Also, the set is interfaced with both the RMI and HSI bearing indicators. The ADF set operates in the 100 to 3,000 kHz frequency range and is used to receive continuous wave (cw) or amplitude modulated (am) radio frequency signals. The three modes of operation for the ADF set include automatic homing in the COMP mode, manual homing in the LOOP mode, and as a communications receiver in the ANT mode. A beat frequency oscillator is included to provide an audible indication for identification and tuning and is activated by the CW VOICE TEST switch.

3-30. CONTROLS AND FUNCTIONS — DIRECTION FINDER SET.

Refer to figure 3-10.

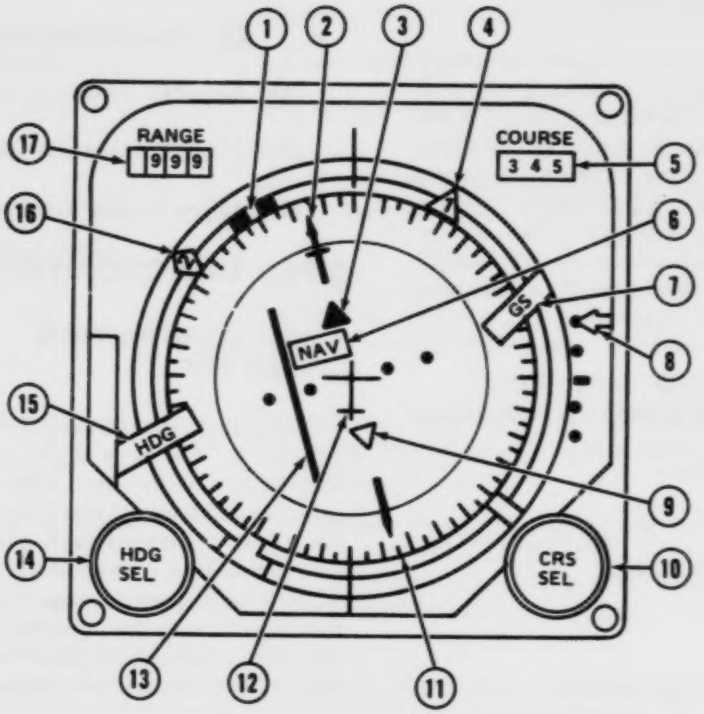
3-31. OPERATION — DIRECTION FINDER SET.

a. **ADF Operation.**

(1) Interphone control panel receiving NAV switch — ON.

(2) Function selector — COMP.

(3) Frequency — Select.


1
2
3
4
RANGE
999
COURSE
3 4 5
17
5
16
6
NAV
GS
7
8
15
HDG
9
14
HDG SEL
CRS SEL
10
13
12
11

209077-312-1C

1. Heading marker
2. Course pointer
3. To indicator
4. Bearing pointer number 1
5. Course readout indicator
6. Navigation warning flag
7. Glideslope flag
8. Glideslope deviation pointer
9. From indicator
10. Course select knob
11. Azimuth indicator
12. Aircraft symbol
13. Course deviation bar
14. Heading select knob
15. Heading flag
16. Bearing pointer number 2
17. Range readout

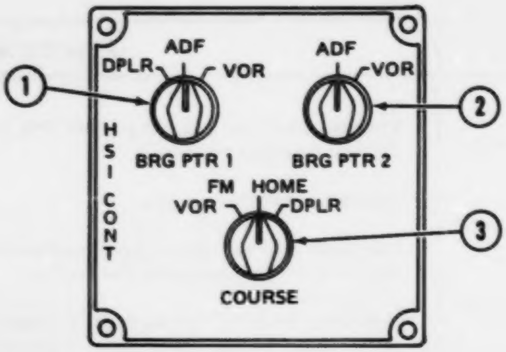
M 17. Range readout

Figure 3-8. Horizontal Situation Indicator (HSI) (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
1. Heading marker	Enables pilot, by adjusting HDG SEL knob, to set the marker to a desired heading reference.
2. Course pointer	Indicates selected course.
3. TO indicator	Indicates selected course is in the direction, within plus or minus 90 degrees, of the course to the station.
4. Bearing pointer number 1	Indicates bearing relative to a ground station (ADF-VOR), as determined by the HSI Display Control Panel (figure 3-9).
5. COURSE indicator	Provides selected course readout (in degrees) to indicate course pointer.
6. NAV warning flag	Indicates loss of radio navigational signal.
7. GS flag	Indicates loss or unreliable glideslope radio signal.
8. Glideslope deviation pointer	Indicates aircraft position relative to glideslope centerline.
9. FROM pointer	Indicates selected course is within plus or minus 90 degrees to the course from the station.
10. CRS SEL knob	Manually adjusts, course pointer and COURSE readout, to set desired course or track for VOR and LOC.
11. Azimuth indicator	Indicates aircraft heading.
12. Aircraft symbol	Provides immediate indication of azimuth relative to desired course and course deviation.
13. Course deviation bar	Indicates aircraft deviation from desired VOR, LOC or FM course or track.
14. HDG SEL knob	Manually adjusts to select desired aircraft heading.
15. HDG flag (warning)	Indicates loss of instrument power or directional gyro information is invalid.
16. Bearing pointer number 2	Indicates bearing relative to a ground radio station (ADF-VOR) as determined by HSI Display Control Panel.
M 17. RANGE readout	Indicates range to destination.

209075-312-2E

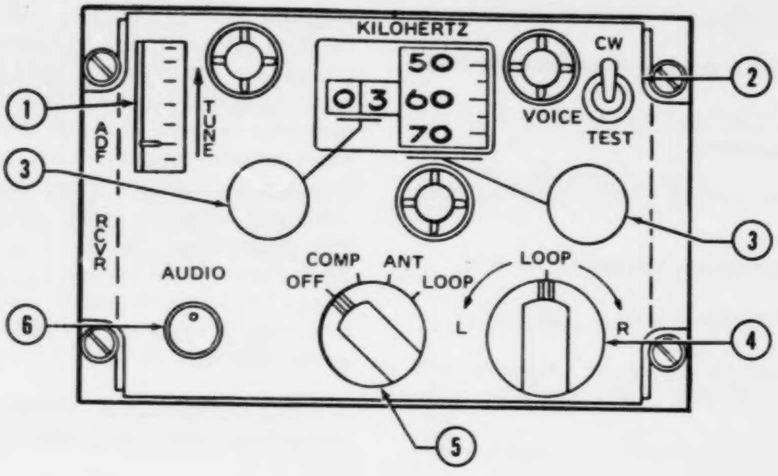
Figure 3-8. Horizontal Situation Indicator (HSI) (Sheet 2 of 2)



CONTROL/INDICATOR	FUNCTION
1. BRG PTR 1 switch M DPLR	Doppler bearing information is presented on HSI bearing pointer number 1.
ADF	ADF bearing information is presented on HSI bearing pointer number 1.
VOR	VOR bearing information is presented on HSI bearing pointer number 1 and VOR bearing is presented on gunner RMI bearing pointer number 2.
2. BRG PTR 2 switch ADF	ADF bearing information is presented on HSI bearing pointer number 2 and ADF bearing is presented on gunner RMI ADF bearing pointer number 1.
VOR	VOR bearing information is presented on HSI bearing pointer number 2 and VOR bearing information is presented on gunner RMI bearing pointer number 2.
3. COURSE switch VOR	Presents selected VOR/LOC station displacement signal information to the HSI course deviation bar and glideslope deviation pointer and VOR/LOC signal information is also presented to the ADI course bar.
FM HOME	Presents FM homing course and glideslope deviation displacement information to both the ADI and HSI pointers.
M DPLR	Presents selected doppler coordinates course deviation to the HSI course deviation bar, doppler signal validity information to the navigation flag of HSI, and displays range to selected destination in range window of HSI.

209077-1C

Figure 3-9. HSI Display Control Panel



CONTROL/INDICATOR	FUNCTION
1. TUNE indicator	Up deflection of the needle indicates most accurate tuning of the receiver.
2. CW VOICE TEST switch	
CW	Provides tone that may be used for identification, tuning, or CW station.
VOICE	Permits normal aural reception.
TEST	Rotates ADF bearing pointer to provide a check of pointer accuracy with function selector in the COMP position, inoperative in LOOP and ANT positions. The switch is spring loaded away from TEST position.
3. Frequency selectors	
Left (course tune)	Selects first two digits of desired frequency.
Right (fine tune)	Selects third and fourth digits of desired frequency.
4. LOOP control	Manual positioning of loop antenna when ADF is operating in manual direction finding mode.
5. Function selector	
OFF	Power off.
COMP	ADF operation as an automatic direction finder.
ANT	Receiver provides aural information only.
LOOP	ADF operation as a manual direction finder using the loop antenna only.
6. AUDIO control	Adjusts receiver volume.

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Figure 3-10. Direction Finder Set AN/ARN-89

(4) AUDIO — Adjust.

(5) TUNE meter — tune for maximum up needle deflection.

b. Manual Operation.

(1) Interphone control panel receiving NAV switch — ON.

(2) Function selector — LOOP.

(3) CW VOICE TEST switch — CW.

(4) Rotate loop for maximum reception and retune.

(5) Rotate loop to find audible null position and adjust volume for a 5 to 8 degree null width.

(6) Check for ambiguity — The ADF bearing pointer will either read the magnetic bearing to the station or be 180 degrees out.

c. Function selection — OFF.

3-32. GYROMAGNETIC COMPASS SET.

3-33. DESCRIPTION — GYROMAGNETIC COMPASS.

The gyromagnetic compass AN/ASN-43 set is a directional sensing system which provides an accurate visual reference indication of magnetic heading (MAG) of the helicopter. The information provided by the system is used for navigation and to control the flight path of the helicopter. The system may also be used as a free directional gyro (DG) in areas where magnetic reference is unreliable. The compass set supplies information to the Horizontal Situation Indicator (HSI) located on the pilot instrument panel (figure 3-8) and a course indicator (RMI) (figure 3-13) located on the gunner instrument panel. The compass system functions as determined by the compass controller C-6347( )/ASN-43 located in the pilot right console.

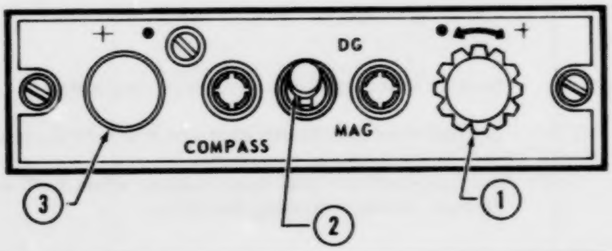
3-34. CONTROLS AND FUNCTIONS — GYROMAGNETIC COMPASS.

Refer to figure 3-11.

3-35. OPERATION — GYROMAGNETIC COMPASS.

a. DG/MAG switch — As desired; DG operation is recommended when flying in latitudes greater than 70 degrees.

b. In MAG mode, the gyromagnetic compass system will remain synchronized during normal flight maneuvers. In normal operation, the annunciator will oscillate slightly about center position; however, during certain aircraft maneuvers, compass system may become unsynchronized, as evidenced by the



CONTROL/INDICATOR	FUNCTION
1 Synchronizing Control	Corrects heading indication when operating in the MAG mode or used as a heading set knob in the DG mode as shown by annunciator null.
2 MAG-DG Switch	
MAG	Provides magnetically slaved information.
DG	Provides for free directional gyro operation.
3 Annunciator	Moves left (+) or right (•) to indicate nonsynchronization or oscillates between (+) and (•) to indicate synchronization.

Figure 3-11. Compass Control Panel C-6347( )ASN-43

annunciator moving off center. The slaving circuits in the compass system will slave slowly to remove errors and synchronize the system. If fast slaving is desired, turn the synchronizing knob in the direction indicated by the annunciator until the annunciator is centered.

c. In the DG mode, the annunciator is inoperative and the gyro is unslaved. Approximately each 15 minutes, update the heading to the standby compass by rotating the synchronizing knob.

3-36. VOR/LOC/GS/MB SYSTEM.

3-37. DESCRIPTION — VOR/LOC/GS/MB SYSTEM.

The VOR/LOC/GS/MB Radio Receiving Set AN/ARN-123(V)1 receives the combined VOR (VHF omni-range) and LOC (localizer) signals over a frequency range of 108.00 to 117.95 MHz, GS (glideslope) signals over a frequency range of 329.15 to 335.00 MHz, and MB (marker beacon) signals on 75.00 MHz from ground transmitters. The signals drive the pilot HSI and ADI (figure 3-12) as applicable, the gunner RMI (figure 3-13) radio bearing pointers, and the marker beacon lights as required. Audio signals may also be received, from the ground transmitters, through the helicopter's intercommunications system by placing the interphone control AUX switch in ON. The set enables the operator to determine his present position, direction to a given point, and fly a predetermined flight-path to a desired destination relative to a VOR facility. The localizer circuitry provides a visual display of the helicopter position relative to a localizer course. The marker beacon circuitry provides a visual display and aural tone to indicate helicopter position relative to a marker beacon transmitter.

3-38. CONTROLS AND FUNCTIONS — VOR/LOC/GS/MB SYSTEM.

Refer to figure 3-14.

3-39. OPERATION — VOR/LOC/GS/MB SYSTEM.

a. NAV VOL control — On and adjust.

b. MB VOL control — On and adjust.

c. CRS SEL Knob — Rotate to 315 degrees. Note course display and VOR/MB switch — Test. Note deviation indicator centrs ± 5 degrees.

d. Frequency selectors — As required.

e. MB SENS switch — As required.

f. HSI control panel COURSE switch — VOR.

g. HSI control panel BRG PTR 1 or BRG PTR 2 — VOR.

h. Interphone control panel AUX switch — ON.

i. Interphone control panel VOL control — Adjust.

3-40. DOPPLER NAVIGATION SET. M

3-41. DESCRIPTION — DOPPLER NAVIGATION SET.

The Doppler Navigation Set, AN/ASN-128 in conjunction with the helicopter heading and vertical reference systems, provides helicopter velocity, position, and steering information from ground level to 10,000 feet. To achieve best results with the set, pitch and roll angles should be limited to 30 degree pitch and 45 degree roll, and moderate maneuver rates should be employed. The Doppler Navigation System is a completely self-contained navigation system and does not require any ground-based aids. The system provides world-wide navigation, with position readout available in both Universal Transverse Mercator (UTM) and Latitude and Longitude (LAT/LONG). Navigation and steering is done using LAT/LONG coordinates, and a bilateral UTM-LAT/LONG conversion routine is provided for UTM operation. Up to ten destinations may be entered in either format and not necessarily the same format. Present position data entry format is also optional and independent of destination format. The set is powered by dc essential bus and protected by the DPLR NAV circuit breaker.

3-42. RESTRICTION — DOPPLER NAVIGATION SET.

The Doppler Navigation Set may be unreliable above 10,000 feet AGL, over land in bank angles above 45 degrees or pitch angles above 30 degrees, over water (Beaufort 1 or less) in bank angles above 30 degrees or pitch angles above 20 degrees. Beaufort 1 is defined as direction of wind shown by smoke but not by wind vanes. This set shall not be used for IFR flight.

3-43. CONTROLS AND FUNCTIONS — DOPPLER NAVIGATION SET.

Refer to figure 3-15.

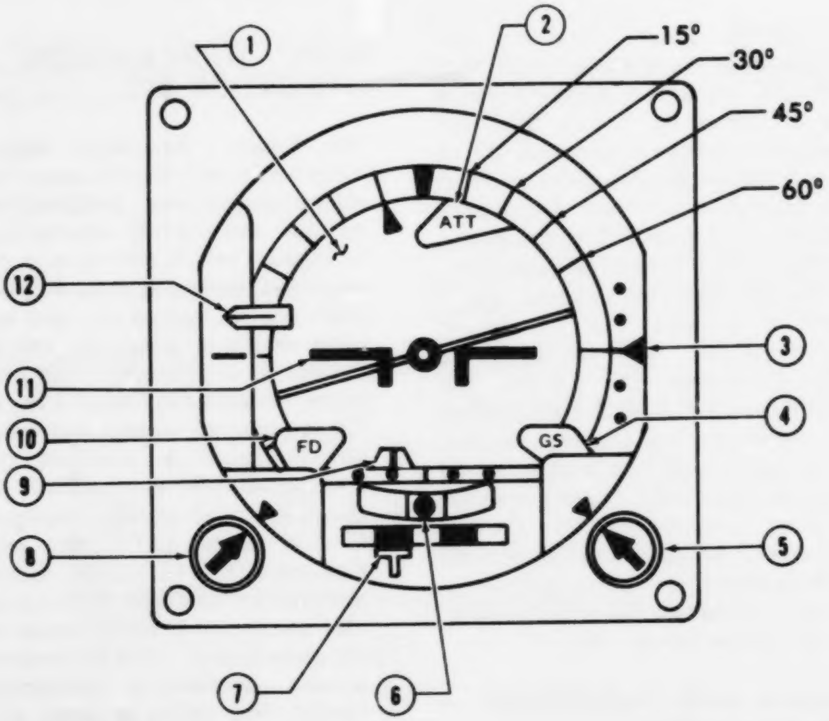
3-44. OPERATION — DOPPLER NAVIGATION SET.

a. MODE switch — LAMP TEST. All lights illuminate.

b. MODE switch — TEST. After 15 seconds, GO illuminates.

c. Refer to TM 11-5841-281-12 for operation.

d. MODE switch — OFF.



1. Sphere
2. Attitude gyro flag
3. Vertical deviation (GS)
4. Glideslope flag
5. Pitch trim
6. Inclinometer
7. Rate-of-turn
8. Roll trim
9. Horizontal deviation
10. Flight director flag
11. Horizontal reference
12. Not used

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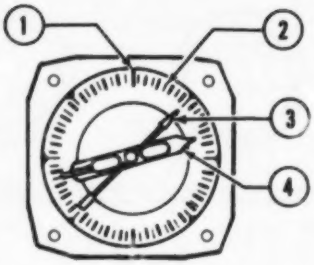
Figure 3-12. Attitude Direction Indicator (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
1. Sphere	Indicates position of horizon relative to the helicopter. Figure 3-12 shows level pitch, 15 degrees right bank.
2. Attitude Gyro Flag	Indicates loss of vertical gyro power or ADI malfunction.
3. Vertical Deviation (GS)	Indicates helicopter position relative to glideslope centerline (ILS) or signal strength (FM homing).
4. Glideslope Flag	Indicates loss of or unreliable radio signal (ILS, FM homing).
5. Pitch Trim	Adjusts artificial horizon up (climb) or down (dive).
6. Inclinometer	Indicates helicopter trim.
7. Rate of Turn	One needle width (4 minute turn); two needle widths (2 minute turn).
8. Roll Trim	Adjusts artificial horizon right or left.
9. Horizontal Deviation	Indicates helicopter deviation from desired VOR, LOC, or FM course or track, and **M** Deviation from desired doppler course.
10. Flight Director Flag	Not used.
11. Horizontal Reference	Indicates helicopter position relative to artificial horizon.
12. Not Used	

Figure 3-12. Attitude Direction Indicator (Sheet 2 of 2)



CONTROL/INDICATOR	FUNCTION
1. Fixed reference	Provides reference point for rotating scale dial.
2. Scale dial	Rotates to indicate helicopter heading relative to the fixed reference point.
3. Pointer No. 1	Indicates course to selected ADF station.
4. Pointer No. 2	Indicates course to selected VOR station.

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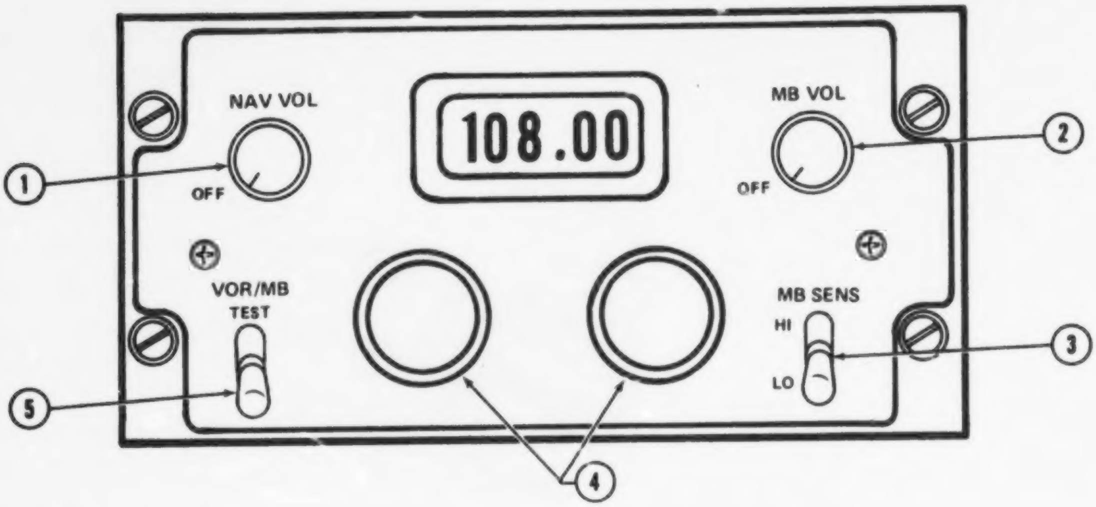
Figure 3-13. Course Indicator (RMI) Gunner



CONTROL/INDICATOR	FUNCTION
1. NAV VOL power switch and volume control	
NAV VOL	Turns set on and controls receiver volume.
OFF	Turns set OFF.
2. MB VOL power switch and volume control	
MB VOL	Turns set on and controls volume.
OFF	Turns set OFF.
3. MB SENS switch	
HI	Increases MB lamp brilliance and audible output as required.
LO	Decreases MB lamp brilliance and audible output as required.
4. Frequency selectors	
Right	Selects the fractional megahertz portion of the desired frequency.
Left	Selects the whole megahertz portion of the desired frequency.
5. VOR/MB-TEST switch	Provides on and off capability for the VOR/MB self-test circuits within the receiver.

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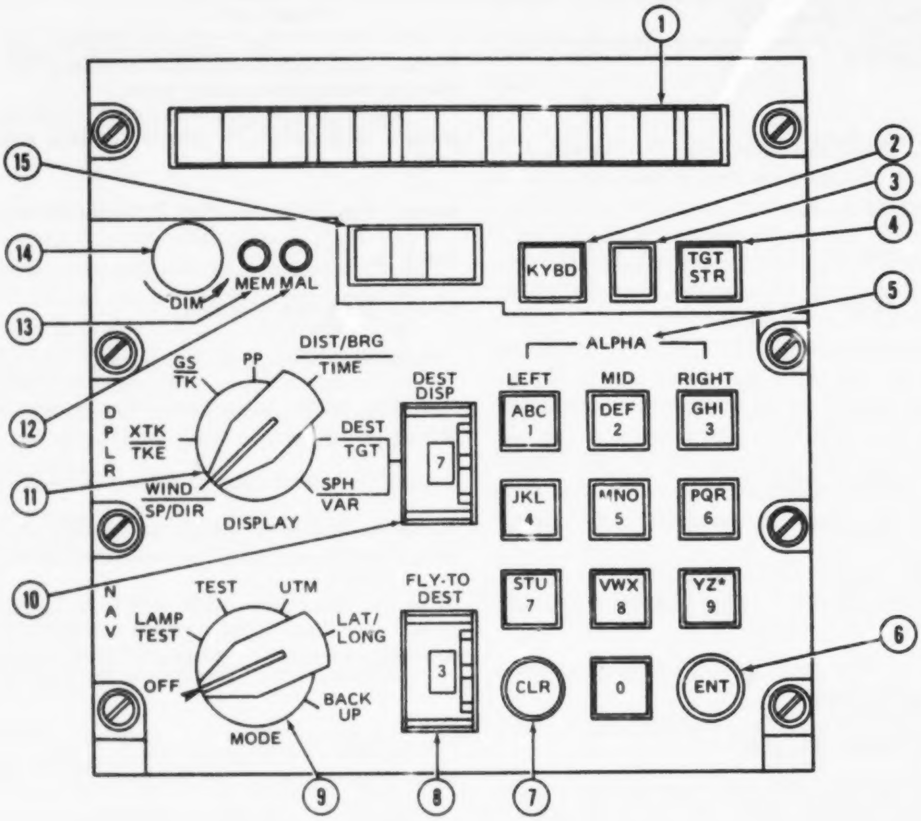
Figure 3-14. VOR/LOC/GS/MB Control Panel C-10048/ARN-123


1
15
2
3
4
14
DIM
MEM
MAL
13
KYBD
TGT STR
5
ALPHA
LEFT
MID
RIGHT
12
DIST/BRG
TIME
PP
GS
TK
D P L R
XTK
TKE
DEST DISP
7
DEST
TGT
ABC 1
DEF 2
GHI 3
11
WIND
SP/DIR
SPH
VAR
DISPLAY
JKL 4
MNO 5
PQR 6
10
N A V
TEST
UTM
FLY-TO DEST
LAMP TEST
LAT/ LONG
STU 7
VWX 8
YZ* 9
6
OFF
3
CLR
0
ENT
BACK UP
MODE
9
8
7

NOTE

NVG compatible filters installed in items 1,3,12,13, and 15.

CONTROL/INDICATOR	FUNCTION
1. Left, Center and Right Display Lamps	Displays alpha numeric characters as determined by alpha keyboard entry.
2. KYBD Pushbutton	Enables keyboard for data entry.
3. TGT STR Indicator	Displays destination number (memory location) in which present position will be stored when the TGT STR push button is pressed.
4. TGT STR	Stores present position data.
5. ALPHA: Left, Mid, Right	Keyboard for entering information into Doppler Navigation System. Alphanumeric characters are by left, center and right display lamps.
6. ENT	Data entry to memory bank.

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M Figure 3-15. Doppler Navigation System (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
7. CLR	Pressed once clears last character entered by ALPHA key. Pressed twice clears entire entry.
8. Fly-to-Dest	Selects destination to which steering information is desired.
9. MODE Switch	Selects Doppler Navigation System (DNS) mode.
OFF	Turns set off.
LAMP TEST	Checks operation of lamps.
TEST	Initiates built-in-test (BIT) exercise.
UTM	Selects UTM (Universal Transverse Mercator) display/entry.
LAT/LONG	Selects latitude/longitude display/entry.
BACKUP	Places navigation set in true air speed plus remembered wind mode of operation, or estimated velocity.
10. DEST DISP	Used in conjunction with DEST/TGT and SPH/VAR positions of the DISPLAY switch to select the destination whose coordinates or magnetic variation are desired.
11. Display Switch	
WIND SP/DIR	Left display — wind speed (km/h). Right display — direction (degrees).
XTK/TKE	Left display — distance crosstrack error (XTK).
	Right display — Degrees of track angle error (TKE).
GS/TK	Left display — Ground speed (GS) is Km/h.
	Right display — track angle (TK).
PP	Present position, used in conjunction with MODE switch.
DIST/BRG/TIME	Distance to fly to destination. Bearing to fly to destination. Time to fly to destination.
DEST/TGT	Destination or target number.
SPH/VAR	SPH spheroid (figure) of destination. VAR magnetic variation in degrees.
12. MAL Indicator Lamp	Illumination indicates malfunction detected by BIT.
13. MEM Indicator Lamp	Indicates radar portion of navigation set is in nontrack condition.
14. DIM Control	Controls light intensity of navigation set.
15. Zone Display	UTM zone.

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M Figure 3-15. Doppler Navigation System (Sheet 2 of 2)

SECTION IV. TRANSPONDER AND RADAR

3-45. TRANSPONDER SET. M

3-46. DESCRIPTION — TRANSPONDER SET.

The transponder set AN/APX-100 enables the helicopter to identify itself automatically when properly challenged by friendly surface and airborne radar equipment. The control panel, located on right hand console, enables the set to operate in modes 1, 2, 3A, 4, and test. When computer KIT-1A/TSEC (classified) is installed, mode 4 is operational. The range of the receiver-transmitter is limited to line of slight transmission since its frequency of operation is in the UHF band making range dependent on altitude.

3-47. CONTROLS AND FUNCTIONS — TRANSPONDER SET.

Refer to figure 3-16.

3-48. OPERATION — TRANSPONDER SET.

a. MASTER control — STBY. Allow approximately 2 minutes for warmup.

b. MODE and CODE — As required.

c. MASTER control — NORM.

d. TEST — As required.

e. ANT — As desired.

f. IDENT — As required.

g. Stopping procedure. MASTER control — OFF.

3-49. EMERGENCY OPERATION — TRANSPONDER SET.

MASTER control — EMER.

3-50. TRANSPONDER SET. P E

3-51. DESCRIPTION — TRANSPONDER SET.

The AN/APX-72 IFF basic equipment enables the helicopter to identify itself automatically when properly challenged by friendly surface and airborne radar equipment. Basic equipment consists of the receiver-transmitter, antenna and control panel which enables the set to operate in modes 1, 2, and 3/A. When Computer KIT-1A/TSEC (classified) is installed mode 4 is operational. Test Set, TS 1843/APX is an inflight test set that is used to indicate either satisfactory or unsatisfactory performance of the overall transponder system on a go-no-go basis. The range of the RT-859/APX-72 is limited to line of sight transmission since its frequency of operation is in the UHF band making range dependent on altitude.

3-52. CONTROLS AND FUNCTIONS — TRANSPONDER SET.

Refer to figure 3-17.

3-53. OPERATION — TRANSPONDER SET.

a. MASTER control — STBY. Allow two minutes for warmup.

b. MODE and CODE — Select as required.

c. TEST — As required.

d. MASTER control — LOW, NORM, EMER as required.

e. IDENT — As required.

f. MASTER control — OFF.

3-54. EMERGENCY OPERATION — TRANSPONDER SET.

MASTER control — EMER.

3-54.1. MODE 4 OPERATION (APX-72 and APX-100).

a. Before Exterior Check.

(1) MASTER switch -- OFF.

(2) CODE switch — HOLD.

(3) CODE HOLD switch (on the pilots misc. control panel) — HOLD. If the CODE HOLD switch is OFF and the MASTER switch is in any position other than OFF, MODE 4 codes will zeroize when the battery switch is turned off during the BEFORE EXTERIOR check.

b. Aircraft Runup — Test.

(1) MASTER switch — STDY for 2 minutes.

(2) CODE switch — A.

(3) MODE 4 TEST/ON/OUT switch — ON.

(4) MODE 4 AUDIO/LIGHT/OUT switch — AUDIO.

(5) MODE 4 TEST/ON/OUT switch — TEST momentarily. The REPLY light should be on. If the REPLY light is not on or the IFF caution light goes on when the switch is at TEST, a malfunction is indicated and MODE 4 shall not be used. Release the switch to the ON position. Further testing to check for correct coding responses is done with ground test equipment by moving the MASTER switch to NORMAL. When the ground test equipment is moved within 50 feet of the aircraft antenna the following indications should be observed if coding is correct.

(6) APX-72.

(a) REPLY light should go on.

(b) Audio tone should be heard.

(c) If the above indications do not occur, select the opposite code (A or B) and repeat the check.

(7) APX-100.

(a) REPLY light should go on.

(b) If the REPLY light does not illuminate and/or the audio tone is heard, select the opposite code (A or B) and repeat check.

(8) If the aircraft transponder does not respond correctly to ground test interrogation, the IFF caution light should illuminate. If there is any indication of an unsatisfactory test, MODE 4 shall not be used.

c. Zeroizing. Mode 4 codes may be zeroized by either of the following methods:

(1) CODE switch — ZERO.

(2) MASTER switch — OFF. If the switch is returned to NORMAL within about 20 seconds, zeroizing may not occur.

(3) Aircraft electrical power — OFF. If the CODE HOLD switch (on the pilot's misc. control panel) is at HOLD and the CODE switch (on transponder) has been moved to HOLD momentarily prior to removing electrical power, zeroizing will not occur in steps (1) and (2) above.

d. Before Takeoff. CODE HOLD switch (on the pilot's misc. control panel) — OFF.

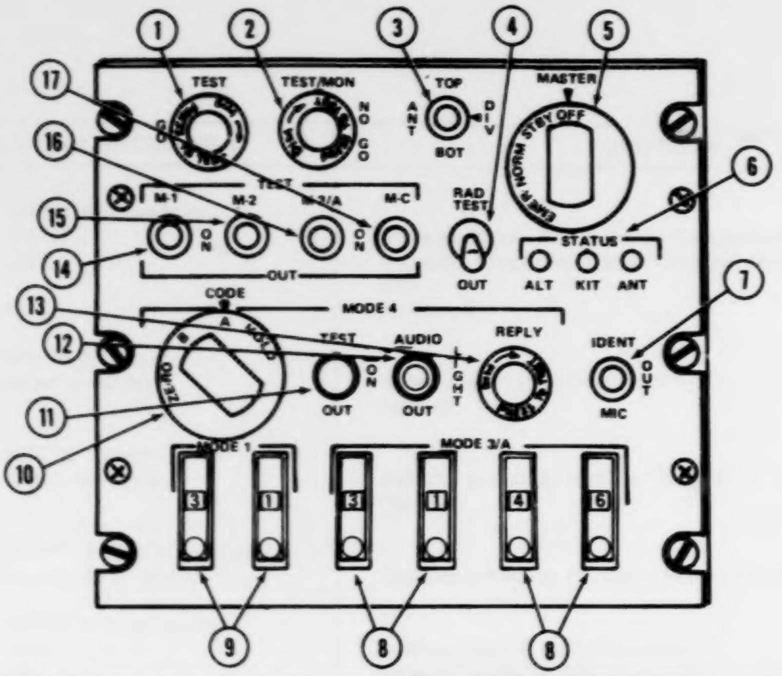
e. Engine Shutdown.

(1) If MODE 4 codes are to be held (not zeroized):

(a) CODE HOLD switch (on the pilot's misc. control panel) — HOLD.

(b) CODE switch (on transponder) — HOLD position momentarily and release to position A or B (as required) and turn MASTER switch to OFF.

(2) If MODE 4 codes are to zeroized, use any of the zeroizing methods above.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17
16
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14
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12
11
10
6
7
9
8
8
TEST
GO
TEST/MON
NO GO
TOP
ANT
DIV
BOT
MASTER
OFF
STBY
NORM
EMER
TEST
M-1
M-2
M-3/A
M-C
ON
ON
OUT
RAD TEST
OUT
STATUS
ALT
KIT
ANT
CODE
MODE 4
A
B
HOLD
ZERO
TEST
AUDIO
LIGHT
ON
ON
OUT
OUT
REPLY
IDENT
OUT
MIC
MODE 1
MODE 3/A
3
1
3
1
4
6

CONTROL/INDICATOR	FUNCTION
1. TEST GO	Indicates successful built in test (BIT).
2. TEST/MON NO GO	Illuminates to indicate unit malfunction.
3. ANT	
TOP	Selects antenna located on top of helicopter.
BOT	Selects antenna located on bottom of helicopter.
DIV	Monitor received signals from both antennas and allows transmission via antenna receiving the strongest signal.
4. RAD TEST switch	
RAD TEST	Enables set to reply to TEST mode interrogations.
OUT	Disables to RAD TEST features.
5. MASTER control	
OFF	Turns set off.
STBY	Places in warmup (standby) condition.
NORM	Set operates at normal receiver sensitivity.
EMER	Transmits emergency replay signal to MODE 1, 2, or 3/A interrogations regardless of mode control settings.
6. STATUS indicators	
ANT	Indicates that built in tast (BIT) or monitor (MON) failure is due to high voltage standing wave ratio (VSWR) in antenna.
KIT	Indicates that built in test (BIT) or monitor (MON) failure is due to external computer.
ALT	Indicates that built in test (BIT) or monitor (MON) failure is due to altitude digitizer.

206075-122-1B

M Figure 3-16. Transponder Set (AN/APX-100) Control Panel (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
7. IDENT-MIC switch	
IDENT	Initiates identification reply for approximately 25 seconds.
OUT	Prevents triggering of identification reply. Spring loaded to OUT.
MIC	Not used.
8. MODE 3/A code select switches	Selects and indicates the MODE 3/A four-digit reply code number.
9. MODE 1 code select switches	Selects and indicates the MODE 1 two-digit reply code number.
10. MODE 4/CODE control HOLD/A/B/ZERO	Selects condition of code changer in remote computer
11. MODE 4 TEST switch	
TEST	Selects MODE 4 BIT operation.
ON	Selects MODE 4 ON operation.
OUT	Disables MODE 4 operation.
12. MODE 4 AUDIO/LIGHT control	
AUDIO	MODE 4 is monitored by audio.
LIGHT	MODE 4 is monitored by a light.
OUT	MODE 4 not monitored.
13. MODE 4/REPLY	Indicates that a MODE 4 reply is generated.
14. TEST/M-1 TEST/ON/OUT	Selects ON, OFF or BIT of MODE 1 operation.
15. TEST/M-2 TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 2 operation.
16. TEST/M-3/A TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 3/A operation.
17. TEST/M-C TEST/ON/OUT	Selects ON, OFF, or BIT of MODE C operation.

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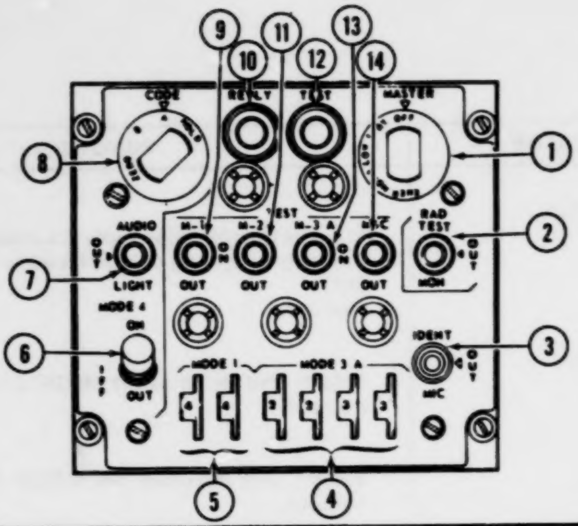
M Figure 3-16. Transponder Set (AN/APX-100) Control Panel (Sheet 2 of 2)


9
10
11
12
13
14
CODE
REPLY
TEST
MASTER
OFF
8
1
TEST
AUDIO
M-1
M-2
M-3 A
M-C
RAD
TEST
2
OUT
ON
ON
ON
OUT
7
LIGHT
OUT
OUT
OUT
OUT
MON
MODE 4
ON
IDENT
3
6
OUT
MODE 1
MODE 3 A
OUT
MIC
5
4

CONTROL/INDICATOR	FUNCTION
1. **MASTER Control**	
OFF	Turns set off.
STBY	Places in warmup (standby) condition.
LOW	Set operates at reduced receiver sensitivity.
NORM	Set operates at normal receiver sensitivity.
EMER	Transmits emergency reply signals to MODE 1, 2, or 3/A interrogations regardless of mode control settings.
2. **RAD TEST — MON Switch**	
RAD TEST	Enables set to reply to TEST model interrogations. Other functions of this switch position are classified.
MON	Allows visual monitoring of valid replies by the transponder to internal or external interrogations on MODES 1, 3, or 3A.
OUT	Disables the RAD TEST and MON features.
3. **IDENT-MIC Switch**	
IDENT	Initiates identification reply for approximately 25 seconds.
OUT	Prevents triggering of identification reply. Spring loaded to OUT.
MIC	Not used.
4. **MODE 3/A Code Select Switches**	Selects and indicates the MODE 3/A four-digit reply code number.
5. **MODE 1 Code Select Switches**	Selects and indicates the MODE 1 two-digit reply code number.

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P E Figure 3-17. Transponder Set Control Panel AN/APX-72 (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
6. MODE 4 Switch	
ON	Enables the set to reply to MODE 4 interrogations.
OUT	Disables the reply to MODE 4 interrogations.
7. AUDIO-LIGHT Switch	
AUDIO	Enables aural and REPLY light monitoring of valid MODE 4 interrogations and replies.
LIGHT	Enables REPLY light only monitoring of valid MODE 4 interrogations and replies.
OUT	Disables aural and REPLY light monitoring of valid MODE 4 interrogations and replies
8. CODE Control	Holds, zeroizes or changes MODE 4 code.
9. M-1 Switch	
ON	Enables the set to reply to MODE 1 interrogations.
OUT	Disables the reply to MODE 1 interrogations.
TEST	Provides test of MODE 1 interrogation by indication on TEST light.
10. REPLY Indicator	Lights when valid MODE 4 replies are present, or when pressed.
11. M-2 Switch	
ON	Enables the set to reply to MODE 2 interrogations.
OUT	Disables the reply to MODE 2 interrogations.
TEST	Provides test of MODE 2 interrogation by indication on TEST light.
12. TEST Indicator	Lights when the set responds properly to a M-1, M-2, M-3/A or M-C test, or when pressed.
	NOTE **Kit-1A/TSEC (classified) computer, must be installed before set will reply to a MODE 4 interrogation.**
13. M-3/A Switch	
ON	Enables the set to reply to MODE 3/A interrogations.
OUT	Disables the reply to MODE 3/A interrogations.
TEST	Provides test of MODE 3/A interrogation by indication on TEST light.
14. M-C Switch	Not used.

209475-329-2H

P E **Figure 3-17. Transponder Set Control Panel AN/APX-72 (Sheet 2 of 2)**

3-55. RADAR WARNING SET.

3-56. DESCRIPTION—RADAR WARNING SET.

The Radar signal detecting set AN/APR-39(V) 1 provides the pilot with visual and audible warning when a hostile fire-control threat is encountered. The equipment responds to hostile fire-control radars but nonthreat radars are generally excluded. The equipment also receives missile guidance radar signals and when signals are time-concident with a radar tracking signal, the equipment identifies the combination as an activated hostile surface-to-air missile (SAM) radar system. The visual and aural displays warn the pilot of potential threat so that evasive maneuvers can be initiated.

3-57. CONTROLS AND FUNCTIONS — RADAR WARNING SET.

Refer to figure 3-18.

3-58. OPERATION — RADAR WARNING SYSTEM.

a. PWR switch — ON. Allow one minute warmup.

b. DSCRM switch—OFF.

c. SELF TEST switch — press and hold. The forward and aft strobes appear and a 2.5 KHz audio is present in the headset. In approximately six seconds, the MA light will start flashing and the audio becomes intermittent.

d. BRIL control — Rotate, check indicator illumniation.

e. AUDIO control — Set.

f. SELF TEST switch — Release.

g. DSCM switch — ON.

h. SELF TEST—Press and hold. One of the strobes appear and a 1.2 KHz audio is present after approximately four seconds. Within approximately six seconds, the other strobe will appear and the audio tone will double. Several seconds later, an alarm audio is heard and missile activity light illuminates.

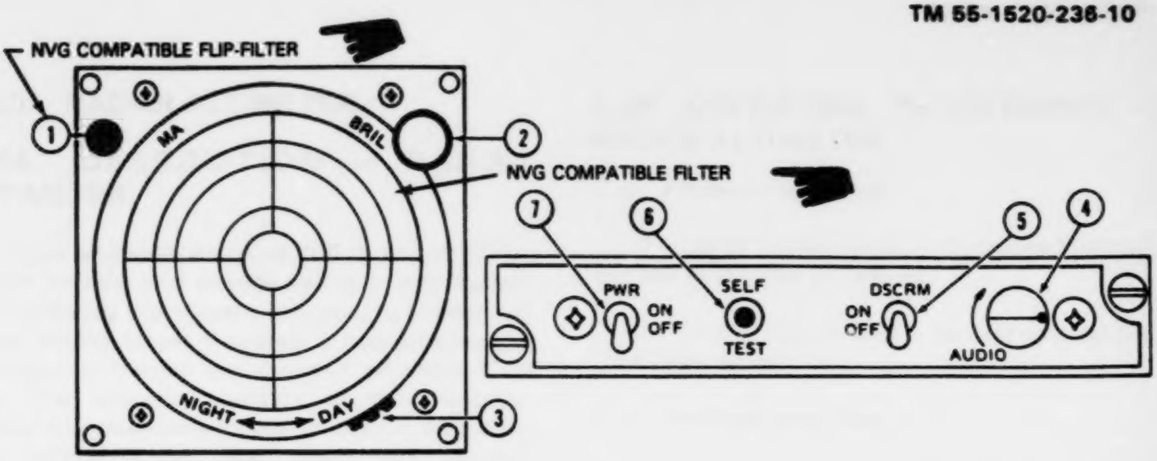
i. SELF TEST— Release.

3-59. Deleted.

3-60. Deleted.

3-61. Deleted.

3-62. Deleted.



CONTROL/INDICATOR	FUNCTION
1. MA indicator	Flashing indicates high radar missile threat.
2. BRIL control	Adjusts indicator illumination.
3. NIGHT—DAY control	Adjust indicator intensity.
4. AUDIO control	Adjusts radar warning audio volume.
5. DSCRM switch:	
OFF	Without missile activity — Provides strobe lines for ground radar and normal audio indications.
	With missile activity — Provides strobe lines for ground radar, flashing strobe line(s) for missile activity, and flashing MA (missile alert) light.
ON	Without missile activity—Threat acquisition and track radar strobes only.
	With missile activity — Flashing strobe lines for missile activity (no strobe lines for ground radar), flashing MA light, and audio warning.
6. SELF TEST switch: with DSCRM switch OFF PWR switch ON. (NOTE: One minute warmup) Monitor CRT and audio & press and hold SELF TEST	Forward and aft strobes appear, extending to approximately the third circle on the indicator graticule and 2.5 khz PRF audio present immediately.
Rotate indicator BRIL control CW & CCW	Within approximately 6 seconds, alarm audio present and MA lamp starts flashing.
Rotate control unit AUDIO control between maximum CCW and maximum CW	Indicator strobes brighten (CW) and dim as control is rotated.
Release SELF TEST	AUDIOS not audible at maximum CCW and clearly audible at maximum CW.
Set DSCRM to ON. Press & hold SELF TEST	All indications cease. Within approximately 4 seconds a FWD or AFT strobe and 1.2 khz PRF audio present. Within approximately 6 seconds the other strobe will appear and APRF audio will double.
7. PWR switch:	
ON	Applies power to radar set.
OFF	De-energizes radar set.

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Figure 3-18. Radar Warning Indicator and Control AN/APR-39

All data on page 3-32 including figure 3-19 is deleted.

3-63. RADAR ALTIMETER.

3-64. DESCRIPTION — RADAR ALTIMETER.

The radar altimeter AN/APN-209 is a short pulse, terrain tracking and altitude sensing radar system that measures and visually indicates by pointer and digital display actual clearance in feet between the helicopter and terrain over a range from zero to 1500 feet. The indicator contains all the electronic components necessary for the generation, reception, and tracking of the radar pulses. The indicator provides precise altitude indications with a manually set low-level and high-level warning flag to warn when a predetermined low or high altitude limit has been reached. Simultaneous operation of the AN/APR-39, radar warning receiver and the AN/APN-209 radar altimeter will cause a strobe to appear on the AN/APR-39 CRT and an audio tone can be heard in the headset for IGE hover.

3-65. CONTROLS AND FUNCTIONS — RADAR ALTIMETER.

Refer to figure 3-20.

3-66 OPERATING PROCEDURES — RADAR ALTIMETER.

a. Altimeter operation.

1. LO SET control knob — Clockwise from OFF. Set low limit index as desired.

2. HI SET control knob — As desired to set high limit index as desired.

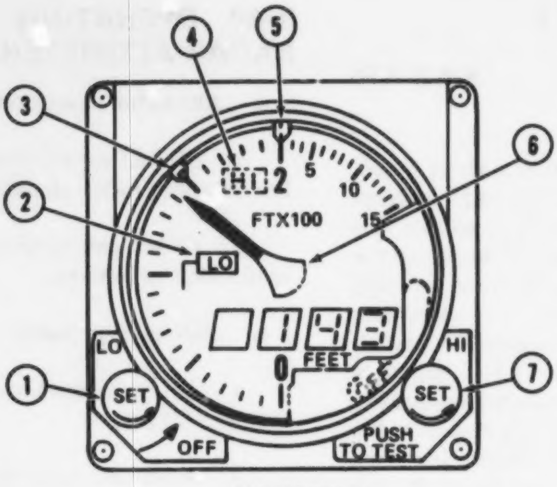
b. Self-test operation.

1. Set high limit index to 800 feet and low limit index to 50 feet.

2. Push and hold HI SET control knob. Verify pointer indicates 1000 (±175) feet, digital display reads 1000 (±100) feet, and HI level warning flag is exposed.

3. Release HI SET control knob. Verify pointer indicates 0 (±5) feet, digital display reads 0 to 3 feet, and LO warning flag is exposed.

c. Stopping procedure. LO SET control knob — Counterclockwise from LO.



ALTIMETER

CONTROL/INDICATOR	FUNCTION
1. LO SET control knob	Turns facility on and off, and sets low limit index.
2. LO level warning flag	Indicates LO when altitude pointer indicates below low limit index.
3. Low limit index	Indicates low altitude limit index setting. Actuates LO level warning flag when limit reached.
4. HI level warning flag	Indicates HI when altitude pointer indicates above high limit index.
5. High limit index	Indicates high altitude limit index. Actuates HI level warning flag when limit reached.
6. Altitude pointer	Indicates actual altitude in feet from helicopter to terrain (zero to 1500 feet).
7. HI SET control knob	Sets high altitude limit index and actuates self-test mode.

206075-124

Figure 3-20. Radar Altimeter

CHAPTER 4 M

MISSION EQUIPMENT

NOTE

Paragraphs 4-1 through 4-3 provide information for the AH-1F (Modernized Cobra) helicopters. Paragraphs 4.1-1 through 4.1-22 provide information for the AH-1P helicopters. Paragraphs 4.2-1 through 4.2-22 provide information for the AH-1E (ECAS) helicopters.

SECTION I. MISSION AVIONICS

4-1. INFRARED COUNTERMEASURE SYSTEM.

WARNING

The countermeasure set must be shut down at least one minute prior to any refueling operation and not restarted or originally started, until the aircraft is in motion.

Do not operate the countermeasure set when the aircraft is in a refueling area.

CAUTION

When energized, the countermeasures set should remain on for a minimum of 15 minutes. Otherwise the life of the source may be drastically shortened.

Complete provisions are provided for the installation of an infrared countermeasure system. Provisions are provided to mount an IR jammer transmitter on top of the engine exhaust suppressor and a control panel in the pilot instrument panel. A failure light is incorporated in the pilot caution panel.

4-1.1. RADAR COUNTERMEASURES SET.

4-1.2. DESCRIPTION — RADAR COUNTERMEASURES SET.

The Radar Countermeasures (CM) Set AN/ALQ-136 provides the aircraft with protection against ground base fire control radars. When operating, the equipment transmits modulating signals at radar frequencies, causing range and angle measurement errors to the radar. The equipment consists of a Receiver-Transmitter RT-1149(V)1 ALQ-136(V)1, Control Indicator C-9576/ALQ, and two antennas AS-3007/ALQ- 136(V), one to transmit, one to receive. A failure light is incorporated in the pilot caution panel.

4-1.3. CONTROLS AND FUNCTIONS — RADAR COUNTERMEASURES SET.

Refer to figure 4-1.

4-1.4. OPERATION — RADAR COUNTERMEASURES SET

a. Warmup - Control switch to STBY. Allow three minutes warmup. An internal timer will prevent the equipment from operating until warmup is complete.

b. Check that RDRCM-INOP failure light on pilot caution panel is not illuminated.

c. Listen to verify that blower in receiver-transmitter is operating. Turn equipment off if the blower fails unless it is needed for defense of the aircraft. Operating the CM set when the blower is not functioning may cause premature failure of the equipment.

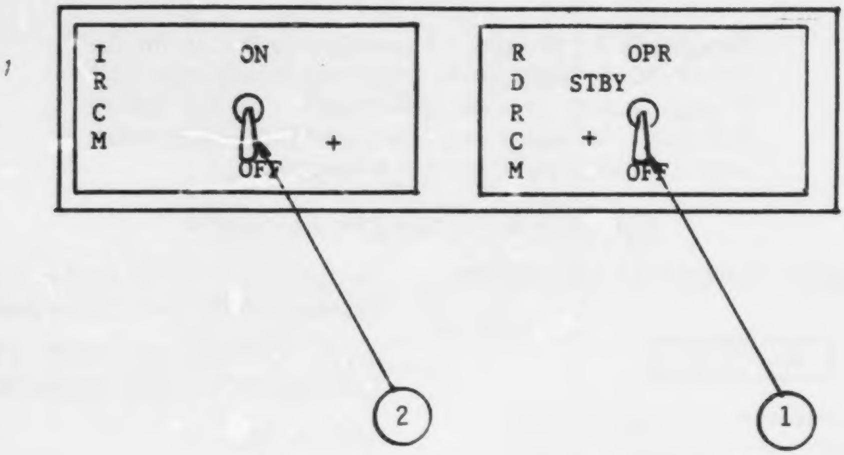
d. Standby - After warmup, with control switch in STBY position, the CM set is in standby, ready for immediate operation. Leave CM set in standby when anticipating a need for its use.

e. Operate - Control switch to OPR when within range of hostile radar.

f. Off - Control switch to OFF. Leave CM set off when not needed. This will extend the service life of the equipment.

4-2. GUN CAMERA.

Complete provisions are provided for installation of a gun camera in the telescopic sight unit.



CONTROL/INDICATOR	FUNCTION
1. Switch/ALQ136	
OFF	Turns CM set off.
STBY	Places CM set in standby (warmup) condition.
OPR	Places CM set in operating condition after 3 minute warmup.
2. Switch/ALQ144	Operates ALQ144.

Figure 4-1. Radar Countermeasures Set Control Indicator.

SECTION II. ARMAMENT

4-3. AUTHORIZED ARMAMENT CONFIGURATIONS.

Figure 4-1.1 shows the authorized armament loading configurations.

4-4. INTERRELATION OF ARMAMENT.

The armament subsystems are interfaced with one another. Completely operational armament systems are dependent upon the following fully-functional equipment.

a. **Telescopic sight unit.**
b. **Helmet sight subsystem.**
c. **Universal turret subsystem.**
d. **Rocket management subsystem.**
e. **TOW missile subsystem.**
f. **Air data subsystem.**
g. **Laser range finder.**
h. **Head-up display system.**
i. **Collective transducer.**
j. **Airborne laser tracker.**
k. **Attitude reference gyro.**
l. **Gyro magnetic compass set.**
m. **Radar altimeter.**
n. **Torquemeter.**
o. **Doppler navigation system.**

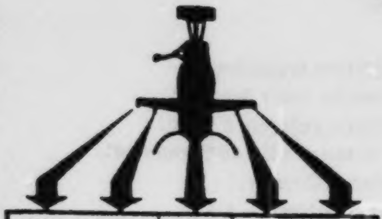
Figure 4-2 shows the pilot and gunner control components in relationship to each armament subsystem.

4-5. ARMAMENT FIRING MODES.

Figure 4-3 shows the switch positions for principal firing modes.

4-5.1 INTEGRATED ARMAMENT FUNCTIONAL DESCRIPTION.

The following is a functional description of the integrated armament system. For specific system operation, refer to paragraphs 4-13 through 4-19 as appropriate.



ARMAMENT CONFIGURATION	WING STORES		TURRET	WING STORES	
1			A		
2	F		A		F
3	F	B	A	B	F
4	F	E	A	E	F
5	F	C	A	C	F
6	D		A		D
7	D	B	A	B	D
8	D	E	A	E	D
9	D	C	A	C	D
10	C	C	A	C	C
11	C	B	A	B	C
12	B	E	A	E	B
13	C	E	A	E	C
14		B	A	B	
15		E	A	E	
16	C		A		C
17	B		A		B
18		C	A	C	
19	B	B	A	B	B
20	B	C	A	C	B

A UNIVERSAL TURRET
(M-197 20MM AUTOMATIC GUN)

B ROCKET LAUNCHER — M200A1
19 TUBE M261

CAUTION

The 19 tube rocket launcher is restricted to a maximum of twelve (12) seventeen (17) pound warhead rockets when mounted on outboard pylons. Refer to Chapter 6 for restrictions on other combinations.

C ROCKET LAUNCHER — M158
7 TUBE M260

D TOW MISSILE —
M65 — TWO LAUNCHERS
(FOUR MISSILES)

E WING GUN POD — M18 OR M18A1
(7.62MM GUN)

F TOW MISSILE
M65 — ONE LAUNCHER
(TWO MISSILES)

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Figure 4-1.1. Authorized Armament Configuration

a. **TOW Modes.** The HUD is used in conjunction with the TMS by displaying the TOW prelaunch window in order to assist the pilot in maneuvering the helicopter to achieve the required missile prelaunch constraints. The HUD display will also indicate when those constraints have been satisfied, and notifies the pilot when to commence evasive maneuvers after the TOW missile launch. A postlaunch HUD display window indicates the maneuver limits for TOW missile steering.

(1) **TOW prelaunch.** Attack Mode (Flashing gunner LOS). The prelaunch constraint window will appear in the pilot HUD and the missile image will appear on the side of the window to correspond to the missile the gunner has selected when the ACTION switch is pressed. Ready Mode (Steady gunner LOS). The gunner LOS will appear steady when the pilot has satisfied all prelaunch constraints.

(2) **TOW Fired Mode.** An "X" will appear over the missile image to show pilot that the firing sequence has started. Once the trigger is pulled, the "X" will appear for about 1.5 seconds prior to the postlaunch mode appearing on the display.

(3) **TOW Postlaunch Mode.** This mode will appear until wire cut on the missile and the pilot is free to maneuver the helicopter within the postlaunch constraints.

(4) **PHS to TSU Acquisition.** The gunner enters this mode by pressing the pilot acquisition switch when the pilot identifies to him that he has a target in the Helmet Sight Line of Sight (LOS). Entering this mode causes the TSU to come into alignment with the pilot helmet sight, thus shortening target acquisition time for the TSU.

(5) **GHS to TSU Acquisition.** The gunner enters this mode by engaging the gunner acquisition switch on the sight hand control when he desires to align the TSU LOS to his helmet sight LOS. Entering this mode causes the TSU to come into alignment with the gunner helmet sight.

(6) **ALT to TSU Acquisition.** The gunner enters this mode by engaging the gunner ALT acquisition switch located in the lower right side of the gunner instrument panel. This mode allows the TSU to be slaved to the ALT while the ALT is locked onto (tracking) a target.

(7) **Solutions Gun and Rocket Fire.** The Fire Control Computer (FCC) provides for concurrent turret gun fire and rocket fire solutions.

In the case of concurrent helmet sight-turret and rocket fire, both modes operate concurrently without degrading either mode using manual range input.

In the case of concurrent TSU-Turret and rocket fire, both modes operate concurrently as far as the computer is concerned; however, while the TSU is being used to support turret gunfire, it cannot be supporting rocket fire. The rocket solution is valid only in the direct mode with RMS estimated range as explained below.

While the TSU is supporting gunfire, the rocket solution may be degraded for two reasons. First, the laser range will be correct for the gun target but not for the rocket target.

Second — Since the TSU is not pointing at the rocket target, LOS information will not be correct for use in the rocket solution in indirect mode.

(8) **Manual Range Guns.** No range countdown is available for the manual range gun mode. The range utilized by the gun solution is SHORT = 1000m, MED = 1500m, LONG = 2000m.

(9) **Gun Moding Discretes.** Three discretes from the IFCU to the FCC tell the FCC which gun solution is currently allowed.

PHS-GUN—	Pilot ACTION switch applies.
GHS-GUN— /TSU-GUN—	Gunner ACTION switch applies.

However, a gun solution will not actually start until the appropriate ACTION switch is pressed.

(10) **Helmet Sight** — Gun With Rocket (estimated or laser range). All rocket modes can operate concurrently with either helmet sight-gun mode because the TSU is not needed in helmet sight modes.

(11) **TSU—Gun (laser range).** If the "TSU-GUN" mode is selected, laser data will be applied to both the TSU gun and the rocket solutions if both are currently operating. The TSU gun solution will be computed if the TSU-GUN is selected and the gunner

ACTION switch is pressed. Initially, if no laser range is available, range data is provided by the setting of the gunner RANGE switch. Laser range information will be used as soon as available and will be extrapolated for 6-seconds after the last laser input. After 6 seconds, manual range will again be used until the next laser input. The Fire Control Solution for the 20mm is limited to 2000m and will not exceed this value even if laser range is higher. Firings beyond 2000m should not be attempted.

(12) Rocket Solutions.

(a) Rocket Solution (laser range). In this mode, the RNG-km switch must be in the "A" position for the FCC to use laser range to calculate the rocket solution. Do not use the "A" mode on the RNG-km switch unless the Laser Range finder is operational.

The FCC will position the fire control reticle to 0°az, 0°el on the HUD. The rocket solution will not be calculated during this time. As soon as laser data is received, the rocket solution will start and the laser data will be used. This data will be extrapolated for 15 seconds after the last laser input. After 15 seconds, the rocket solution will stop and the fire control reticle will be positioned by the FCC to 0°az, 0°el on the HUD. While laser data is being extrapolated, the current value used in the extrapolation is displayed on the HUD. After the 15 second time elapses, the last extrapolated range value will be displayed on the HUD. The rocket ballistic solution does not make any allowance for target motion.

If the TSU is being used to fire the gun and the gunner lases on the gun target, the rocket solution will be incorrect in both the direct and indirect modes, unless both the gun and rockets are firing on the same target:

Rocket Direct — The solution is incorrect because the range is for the wrong target. Rocket range remains good if gunner does not lase on the gun target.

Rocket Indirect — The solution is incorrect for two reasons; one, the range is for the wrong target and, two, the LOS information is for the gun target rather than the rocket target.

(b) Rocket Solution (RMS estimated range). In this mode, the rocket solution will be calculated continously. The range value displayed in the RMS RNG-km switches will be used for the initial range value and displayed on the HUD. This range will not be counted down except following a change in the setting.

A change in the setting will be the signal to start counting down range based on velocity inputs. Range will count down for 15 seconds or until the range is less than 50 meters, whichever occurs first. It will then reset to the initial value and will not count down again until the switches are changed again. If the aircraft moves such that the target is not straight ahead, the computer uses magnetic heading, vertical gyro, and doppler information to extrapolate the range correctly. In either manual range mode (Direct or Indirect), whenever the switches are first set or changed, the aircraft must be aligned such that the target is straight ahead. During the countdown sequence, the HUD will display the current counted down range. As the range counts down, the range value used in the rocket solution will be limited to a minimum of 50 meters.

If firing FUSE SET rockets, the RNG-km switches sets the fuse at the range selected on the switches regardless of what range is displayed in the HUD. If the laser is operational and the RNG-km switch is in "A", the time of function for the fuse set comes from the computer.

(c) Related Items.

1. **Rocket Mode Lasing.** In both direct and indirect rocket modes, the computer allows the gunner to begin lasing before the ship is aligned with the target and this laser data be applied correctly to the solution. In the indirect mode, the TSU must be on the target when the rockets are fired. This is not true for the direct mode. In both direct and indirect modes after lasing stops for 1/4 second, the computer uses magnetic heading, vertical gyro, and doppler to extrapolate range in the off-axis situation.

2. **Laser Ranging.** If the gunner holds the laser trigger down, the laser sends data to the FCC at a rate of 4 times per second. The FCC will continue to use the data, integrated with doppler data, for the fire control solution and will send time of function to the RMS for fuse setting. Along with range data displayed on the HUD, will be one of two letters — F or L. They define the source of the range data being displayed.

F — Range from FCC.
L — Raw Laser Range (in case of FCC failure).

4-6. ARMAMENT DESCRIPTION.

a. **Universal Turret.** The universal turret system (figure 4-4) (TM 9-1090-206-12) provides for positioning, sighting, ammunition feeding, and firing of the M-197 20 mm gun. The system consists of a turret assemby, turret control unit, logic control unit, pressure transducer, ammunition feed system with boost assembly, gun control unit, recoil assembly, slider assembly, and gun drive assembly. The turret is operated by 28vdc and 115vac, 400 hertz power provided by the helicopter electrical system. The turret weapon can be fired in the fixed or flexible mode by the pilot, flexible mode by the gunner. The turret can travel 110 degrees left or right in azimuth and 13 to 21 degrees up (varying with the turret azimuth position) and 50 degrees down in elevation. The turret fires a burst of 16 ± 4 rounds when the cyclic trigger switch is pressed to the first detent, and fires a continuous burst at 730 ± 50 rounds per minute when the cyclic trigger switch is pressed to the second detent. When the turret is slewed more than five degrees in azimuth, and an action switch is pressed to enable firing rockets or TOW missiles, the wing stores lockout circuitry is activated and the turret will stow to zero degrees azimuth and elevation to preclude the possibility of a turret round detonating the rockets or missile in close proximity to the helicopter. If the turret is slewed less than 5 degrees in azimuth, and an action switch is pressed to enable firing rockets on TOW missiles, the wing stores lockout circuitry becomes activated which stops the gun from firing, and the turret will not stow to zero degrees agimuth or elevation. The capacity of the ammunition and feed system is 750 rounds of continously belted ammunition.

CONTROL COMPONENTS	TURRET	TOW MISSILE	WING STORES		TARGET ACQUIRE FOR TSU	WING STORES JETTISON
			ROCKETS	GUN POD		
Pilot Station						
Armament Control Panel	X	X	X	X	X	
Rocket Management System (RMS) Display Unit			X			
Jettison Select Switches						X
Head Up Display	X	X	X	X		
Helmet Sight	X				X	
Cyclic Switches	X		X	X		
Gunner Station						
Cyclic Switches	X		X	X		
Helmet Sight	X				X	
Telescopic Sight Unit	X	X				
Left-Hand Grip	X	X				
Armament Control Panel	X		X	X		
Wing Stores Jettison Switches						X
Sight Hand Control	X	X			X	
TOW Control Panel	X	X			X	
Acquisition Panel					X	

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Figure 4-2. Control Components in Relationship to Armament Subsystems

COLUMN	FIRING MODES	Pilot Switches																
		Armament Panel					Cyclic Grip			HUD			RMS					
		MASTER ARM	WPN CONTR	MAN RANGE	WING STORE	RECOIL	ACTION	GUN	WING ARM FIRE	RKT	PWR	MODE	ZONE ARM	PEN-M	RATE	MODE	QTY	RNG-KM
1	TSU Firing Gun	ARM	GUNNER			COMPEN												
2	GHS Firing Gun	ARM	GUNNER			COMPEN												
3	PHS Firing Gun	ARM	GUNNER PILOT	Select		COMPEN	Press	Press										
4	Fixed Firing Gun	ARM	FIXED				Press	Press			ON	NORM						
5	Rocket Direct Mode	ARM			RKT				Press	DIR	ON	NORM	Select	Select	Select	Select	Select	A Select
6	Rocket Indirect Mode	ARM			RKT				Press	IND	ON	NORM	Select	Select	Select	Select	Select	A Select
7	Rockets With-OUT FCC	ARM			RKT				Press	DIR	ON	NORM	Select	Select	Select	Select	Select	Select
8	Rockets With-OUT FCC OR LRF	ARM			RKT				Press		ON	STAD	Select	Select	Select	Select	Select	Select
9	PLT ORIDE Rockets Gun																	
10	TOW Prelaunch Mode	ARM	GUNNER								ON	NORM						
11	TOW Post-launch Mode	ARM	GUNNER								ON	NORM						
12	PHS to TSU Acquisition	ARM	GUNNER															
13	GHS to TSU Acquisition	ARM	GUNNER															
14	ALT to TSU Acquisition	ARM	GUNNER															
15	HUD TEST Mode										ON	TEST						

209075-403-1A

Figure 4-3. Armament Firing Modes (Sheet 1 of 2)

COLUMN	Gunner Switches															
	TCP		LASER RANGE	Right Console					Left Hand Grip			Sight Hand Control	Inst Panel	Cyclic Grip		
	MODE SELECT	LASER ARM	MIN RANGE	RANGE	PLT ORIDE	WING STORE	TURRET DEPR LIMIT	TUR SLEW	ACTION	TRIGGER	LASER	ACQ TRK STOW	ACQ	WING ARM FIRE	ACTION	GUN
1	TSU GUN	Select	Select	Select	OFF		OFF	NORM	Press	Press	Press	TRK				
2				Select	OFF		OFF	NORM	Press	Press		STOW				
3					OFF		OFF	NORM								
4					OFF											
5	TSU GUN	Select	Select		OFF						Press	TRK				
6	TSU GUN	Select	Select		OFF						Press	TRK				
7	TSU GUN	Select	Select		OFF						Press	TRK				
8					OFF											
9				Select	PLT ORIDE	RKT GUN								Press	Press	Press
10	ARMED				OFF				Press	As Desired		TRK				
11	ARMED				OFF				Press	Press						
12	TSU GUN or TOW				OFF							TRK	PHS ACQ			
13	TSU GUN or TOW				OFF							ACQ				
14	TSU GUN or TOW				OFF								ALT ACQ			
15																

209075-403-2A

Figure 4-3. Armament Firing Modes (Sheet 2 of 2)

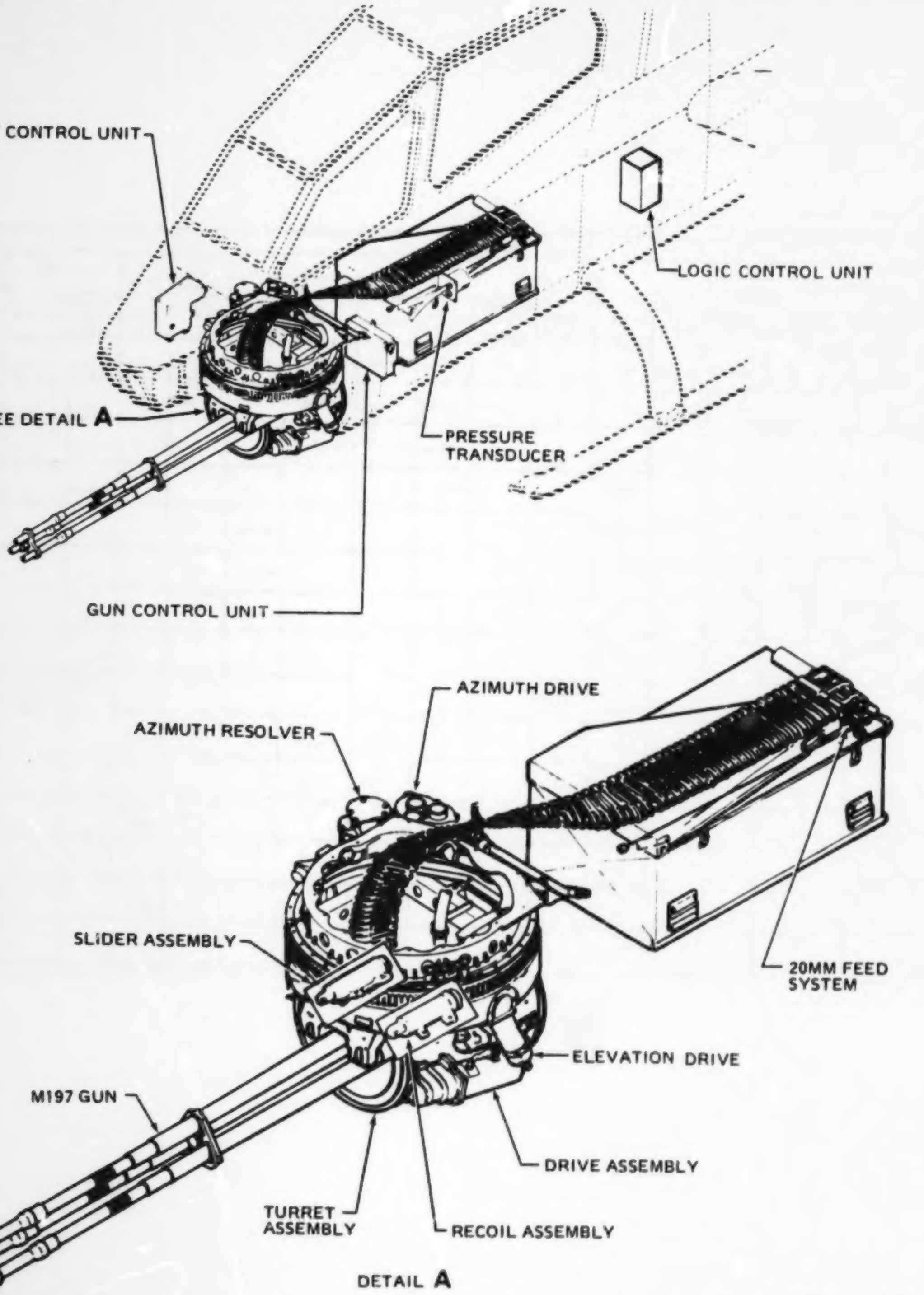

TURRET CONTROL UNIT
LOGIC CONTROL UNIT
SEE DETAIL A
PRESSURE TRANSDUCER
GUN CONTROL UNIT
AZIMUTH DRIVE
AZIMUTH RESOLVER
SLIDER ASSEMBLY
20MM FEED SYSTEM
ELEVATION DRIVE
M197 GUN
DRIVE ASSEMBLY
TURRET ASSEMBLY
RECOIL ASSEMBLY
DETAIL A
209071-391E

Figure 4-4. Universal Turret Components

b. TOW Missile. The TOW (tube-launched, optically-tracked, wire command link) missile subsystem (TM 9-1425-473-20) is a heavy anti-tank/assault weapon. The subsystem utilizes optical and IR (infrared) means to track a target and guide the missile. Isolation from helicopter motions and vibrations is provided. One or two TML (TOW Missile Launcher) (figure 4-5) supports two missiles each on the outboard ejector racks.

NOTE

The subsystem is designed to be effective during daylight conditions. Use at night may be effective if flares are used to augment visibility. Problems with glare on sight reticles, inability to adjust reticle in intensity during target tracking, and difficulty in acquiring targets at unknown locations during darkness, will degrade system performance during night operations.

c. Rockets. The Rocket Management Subsystem (RMS) (TM 9-1090-207-13) is a light anti- personnel assault weapon. The RMS consists of a Display Unit (Rockets) panel located in the pilot station (figures 2-6 and 4-11) and two Operations Units located in the leading edge of the wings, one for each of the inboard wing stores racks. The RMS permits the pilot to select the desired type of 2.75 inch folding fin aerial rocket (FFAR) warhead, fuze, quantity, range, and rate. Seven or 19 tube launchers can be mounted on each of the inboard and outboard wing stores racks. The rocket launchers are divided into zones as shown in figure 4-6.

d. Wing Gun Pod. The pod (figure 4-7)(TM 9-1005-257-12) is a self-contained unit, housing a 7.62 mm machine gun, electrical system, a battery recharging system, and a maximum of 1500 rounds of ammunition. The gun is capable of firing 2000 or 4000 (M18A1) or 4000 (M18) rounds per minute. The pod configuration can be identified by the firing rate and heater switchs on the rear of the pod.

e. Wing Stores Jettison. Each of the four ejector racks are equipped with an electrically operated ballistic device to jettison the attached weapon during an emergency. Each device has two cartridges. The second cartridge fires automatically if the first fails to fire. Wing stores jettison switches are shown in figure 4-8. When four TOW missile launchers are installed on outboard wing stations the TOW missile launchers will jettison prior to the inboard stores regardless of the jettison select switches position.

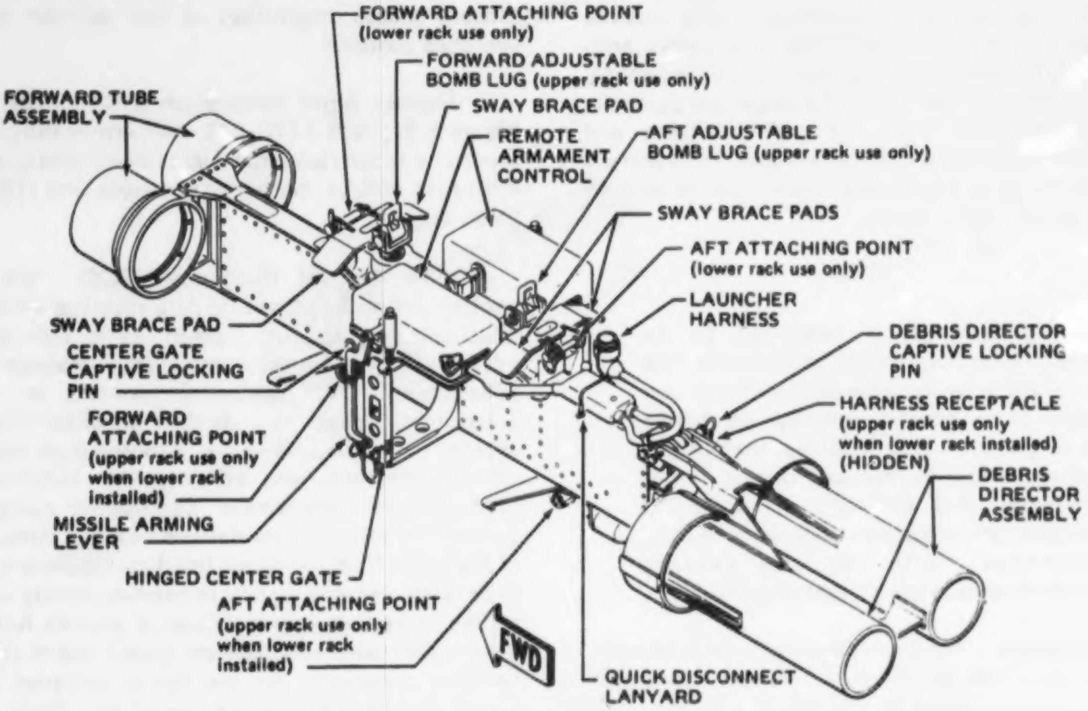
f. Helmet Sight Subsystem (HSS). The HSS (figure 4-9) (TM 9-1270-212-14) permits the pilot or gunner to rapidly acquire visible targets and to direct the turret and/or the telescopic sight unit (TSU) to those targets.

g. Fire Control Computer (FCC). The fire control computer computes data received from the telescopic sight unit, helmet sight subsystem, universal turret subsystem, rocket management subsystem, TOW missile subsystem, air data subsystem, laser rangefinder, head-up display system, collective transducer, airborne laser tracker, attitude reference gyro, gyro magnetic compass set, radar altimeter, torquemeter, and doppler navigation system. The solution data derived from the integration of the inputs from the above listed components is used to develop electrical signals to head-up display system for the rocket fire control reticle, to provide fuse settings to the rocket management system and to provide ballistics corrections for the 20mm universal turret system through the interface control unit. Flight information, torque, magnetic heading, and radar altimeter altitude is displayed in the HUD.

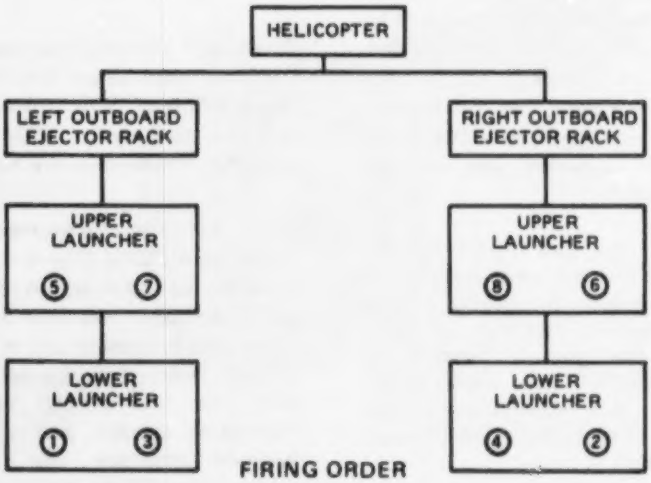
The GACP electrical connector must be installed on the stow receptacle when the GACP is not installed to allow firing of TOW missiles. The GACP includes circuitry to prevent TOW missile firing when the GACP is installed in the helicopter.

h. Air Data Subsystem (ADS). The air data subsystem (ADS) (TM 9-1270-219-13) consists of an airspeed and direction sensor (AADS) (figure 2- 1), a low airspeed indicator (LAI) (figure 2-22) and an electronic processor unit (EPU) which is mounted on the bulkhead aft of the pilot seat. The ADS interfaces with the fire control computer (FCC), doppler navigation system, and radar altimeter to enhance weapon accuracy. The ADS electrical circuit is powered by 28vdc and protected by the ADS PWR circuit breaker (figure 2-19).

(1) Airspeed and Direction Sensor (AADS). The airspeed and direction sensor is a swiveling pitot-static probe which measures pitot and static pressures, the angles of the airflow relative to the helicopter and the free stream air temperature.


FORWARD ATTACHING POINT (lower rack use only)
FORWARD ADJUSTABLE BOMB LUG (upper rack use only)
FORWARD TUBE ASSEMBLY
SWAY BRACE PAD
REMOTE ARMAMENT CONTROL
AFT ADJUSTABLE BOMB LUG (upper rack use only)
SWAY BRACE PADS
AFT ATTACHING POINT (lower rack use only)
LAUNCHER HARNESS
SWAY BRACE PAD
CENTER GATE CAPTIVE LOCKING PIN
DEBRIS DIRECTOR CAPTIVE LOCKING PIN
HARNESS RECEPTACLE (upper rack use only when lower rack installed) (HIDDEN)
FORWARD ATTACHING POINT (upper rack use only when lower rack installed)
DEBRIS DIRECTOR ASSEMBLY
MISSILE ARMING LEVER
HINGED CENTER GATE
AFT ATTACHING POINT (upper rack use only when lower rack installed)
FWD
QUICK DISCONNECT LANYARD

LAUNCHER


HELICOPTER
LEFT OUTBOARD EJECTOR RACK
RIGHT OUTBOARD EJECTOR RACK
UPPER LAUNCHER
⑤ ⑦
UPPER LAUNCHER
⑧ ⑥
LOWER LAUNCHER
① ③
LOWER LAUNCHER
④ ②

FIRING ORDER

209071-343A

Figure 4-5. TOW Missile Launcher

(2) Electronic Processor Unit (EPU). The electronic processor unit computes and converts AADS outputs into airspeed components and temperature and pressure outputs.

(3) Low Airspeed Indicator (LAI). Refer to Chapter 2. Weapon firing in the 26 to 32 knot airspeed range will result in degraded accuracy in helicopters equipped with K747 blades.

(4) ADS versus Radar Altimeter Relationship. The Air Data System (ADS) uses the input from the radar altimeter AN/APN-209 to determine IGE or OGE effect on airspeed. If the radar altimeter is turned OFF or failed the ADS will be based on data based on 33 feet regardless of helicopter altitude. This function can be checked while hovering IGE by pushing the test switch on the radar altimeter and observing the jump in the low airspeed indicator bar. In the test condition, the AN/APN-209 tells the ADS that the helicopter is at 1000 ft ± 100 ft.

i. Airbone Laser Tracker (ALT). The airborne laser tracker (figure 4-9.1) is used to automatically scan the terrain, detect and lock onto a laser designated target. The ALT automatically tracks the target and when commanded, aims the telescopic sight unit to the ALT line of sight. The ALT consists of a receiver, electronics assembly, and control panel. The receiver is a barrel-shaped housing with a glass dome that contains the laser seeker, and is located in forward pylon fairing assembly. The electronics assembly, contains the ALT plug-in modules and power supply, and is located in the aircraft behind the receiver. The control panel contains the ALT controls and indicators, and is located in the pilot's cockpit.

j. Head Up Display HUD). The HUD visually presents required symbology for flight and weapons firing on a partially reflective beam splitter superimposed on real world image. The primary use of the HUD is for aiming the helicopter to fire rockets and to provide the pilot steering indications for meeting the helicopter constraints in operation of the TOW missile system. The secondary use of the HUD is for display of the engine torque, radar altitude, magnetic heading, and range for flight safety purposes when the pilot is flying head-up with eyes focused outside the cockpit. The components of the HUD are the head-up display, signal processor, and HUD boresightable mount.

4-7. PILOT SWITCHES AND INDICATORS.

Pilot panels and switches are interfaced with other pilot/gunner panels and switches for weapon operations and wing stores jettison. Figure 4-3 shows switch interface.

All data on page 4-9 is deleted.

LAUNCHER ZONING

ZONE 1 — Outer ring of 19 tube launcher when installed on outboard wing stores rack for a total of 24 rockets.

ZONE 2 — Two top and two bottom tubes of the inner ring of 19 tube launcher or two top and two bottom tubes of the outer ring of 7 tube launcher, when installed on outboard wing stores rack for a total of 8 rockets.

ZONE 3 — Outer ring of 19 tube launcher when installed on inboard wing stores rack for a total of 24 rockets.

ZONE 4 — Two top and two bottom tubes of the inner ring of 19 tube launcher or two top and two bottom tubes of the outer ring of 7 tube launcher, when installed on inboard wing stores rack for a total of 8 rockets.

ZONE 5 — Center three tubes of 19 tube and 7 tube launchers for a total of 12 rockets.

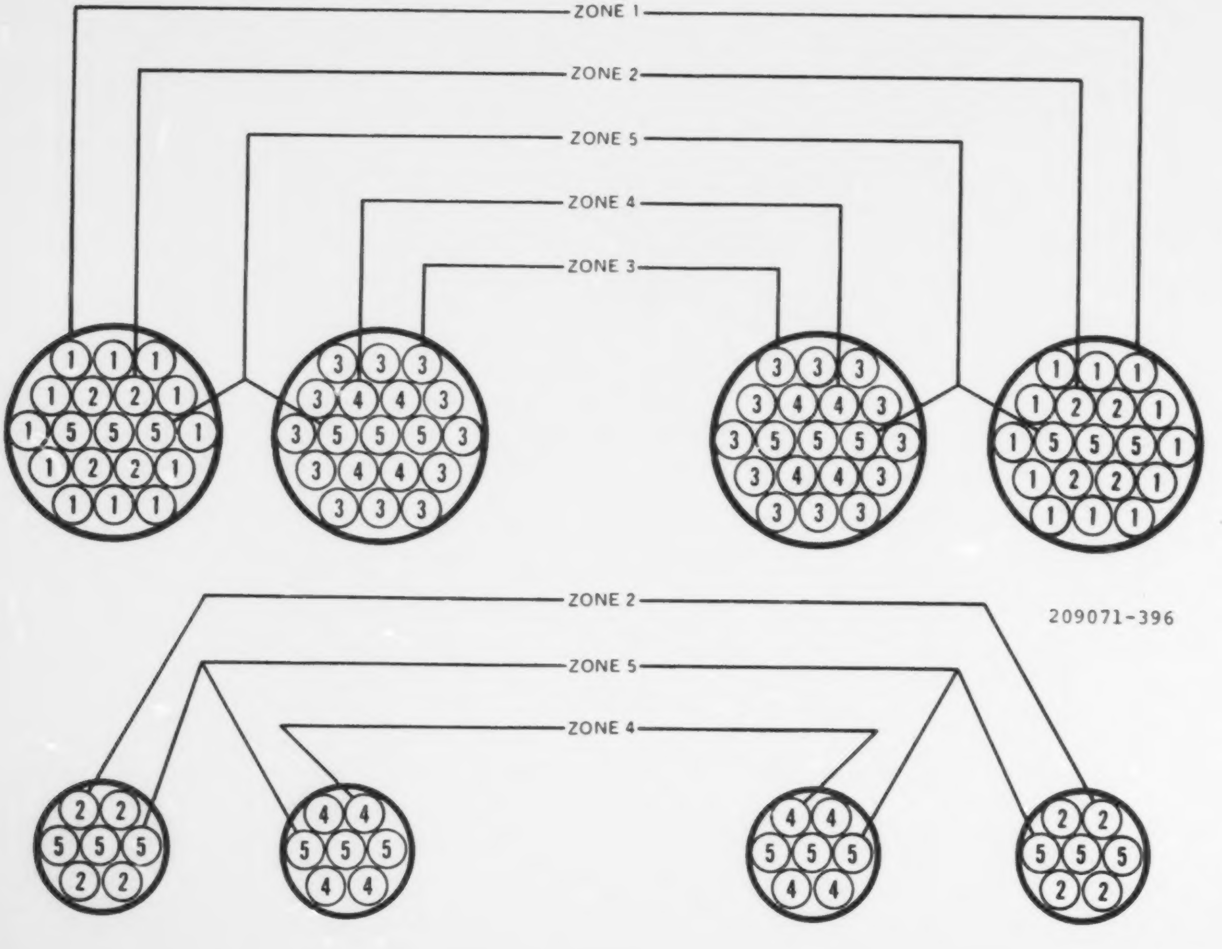


Figure 4-6. Folding Fin Aerial Rocket (2.75 inch) Launcher

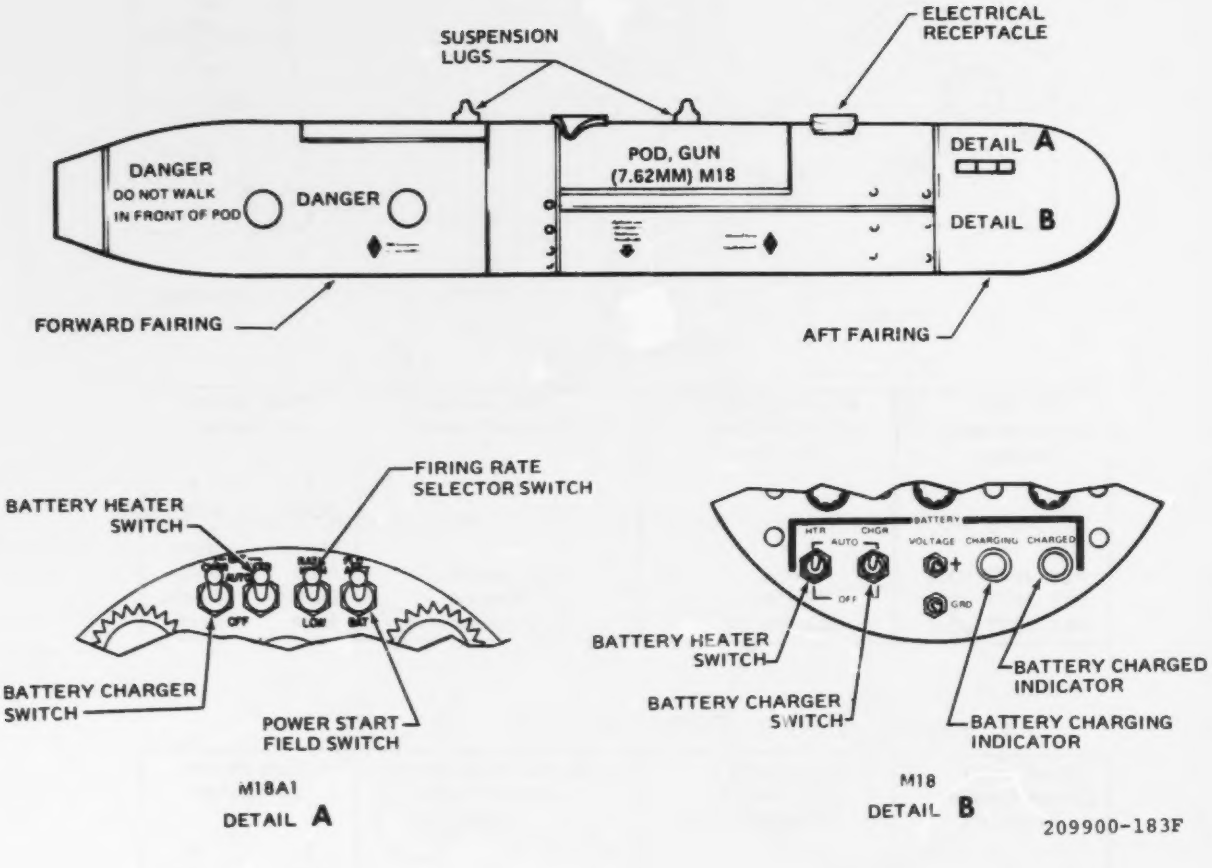
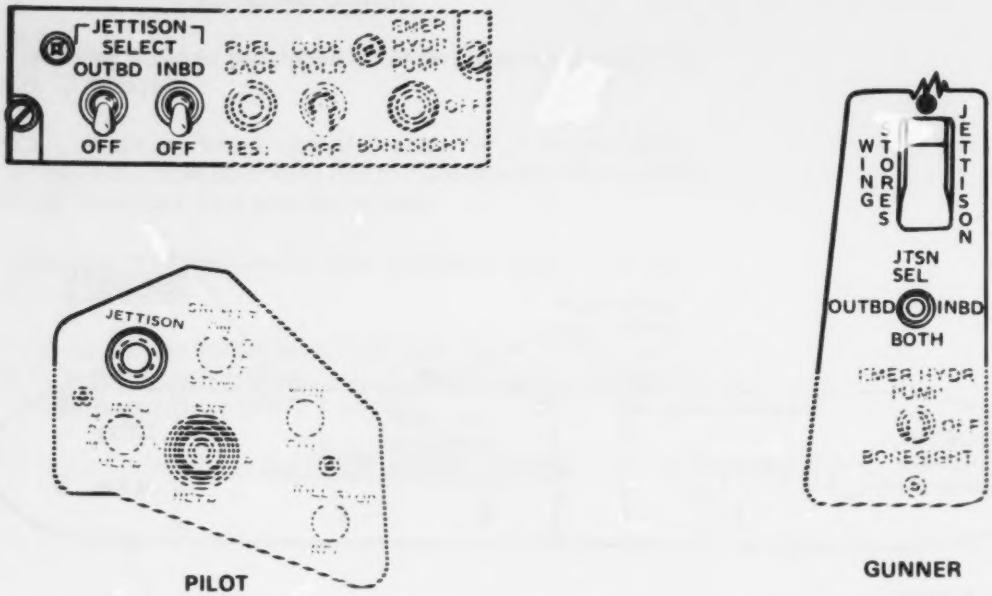

SUSPENSION LUGS
ELECTRICAL RECEPTACLE
DETAIL A
DANGER
DO NOT WALK IN FRONT OF POD
DANGER
POD, GUN (7.62MM) M18
DETAIL B
FORWARD FAIRING
AFT FAIRING
FIRING RATE SELECTOR SWITCH
BATTERY HEATER SWITCH
AUTO
OFF
LOW
BAT
BATTERY CHARGER SWITCH
POWER START FIELD SWITCH
M18A1
DETAIL A
BATTERY
HTR
CHGR
AUTO
OFF
VOLTAGE
+
GRD
CHARGING
CHARGED
BATTERY HEATER SWITCH
BATTERY CHARGER SWITCH
BATTERY CHARGED INDICATOR
BATTERY CHARGING INDICATOR
M18
DETAIL B
209900-183F

Figure 4-7. Wing Gun Pod


JETTISON SELECT
OUTBD
INBD
OFF
OFF
FUEL GAGE
CODE HOLD
EMER HYDR PUMP
TEST
OFF
BORESIGHT
JETTISON
WING STORES
JETTISON
JTSN SEL
OUTBD
INBD
BOTH
EMER HYDR PUMP
OFF
BORESIGHT

PILOT

GUNNER

PILOT JETTISON

PLT JETT Circuit Breaker Position	Pilot JETTISON SELECT Switch Position	Pilot Jettison Switch Position	Wing Stores Jettisoned	
			2 TOW	4 TOW
OFF	*	*	None	None
PLT JETT (On)	Inbd	Pressed	Inbd	Both
PLT JETT (On)	Outbd	Pressed	Outbd	Outbd
PLT JETT (On)	Inbd/Outbd	Pressed	Both	Both

GUNNER JETTISON

GNR JETT Circuit Breaker Position	Gunner JTSN SEL Switch Position	Gunner Wing Stores Jettison Switch Position	Wing Stores Jettisoned	
			2 TOW	4 TOW
OFF	*	*	None	None
GNR JETT (On)	Inbd	Up (On)	Inbd	Both
GNR JETT (On)	Outbd	Up (On)	Outbd	Outbd
GNR JETT (On)	Both	Up (On)	Both	Both

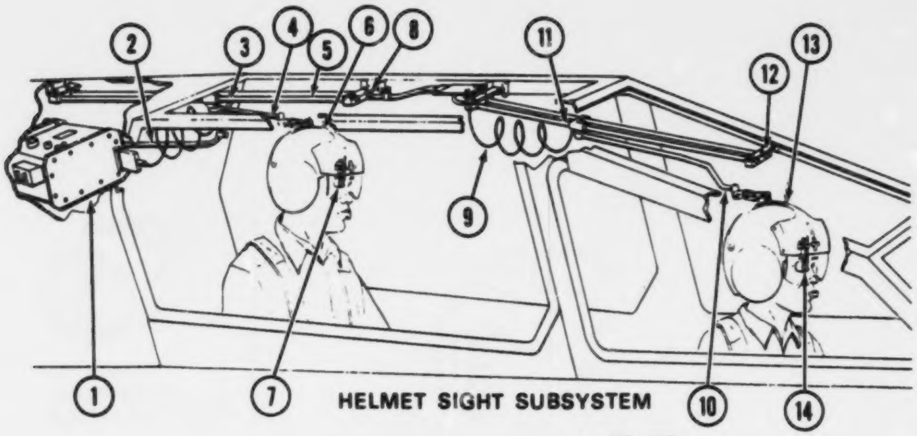
*Switch position makes no difference.

In the BOTH jettison sequence the outboard stores leave first followed by the inboard.

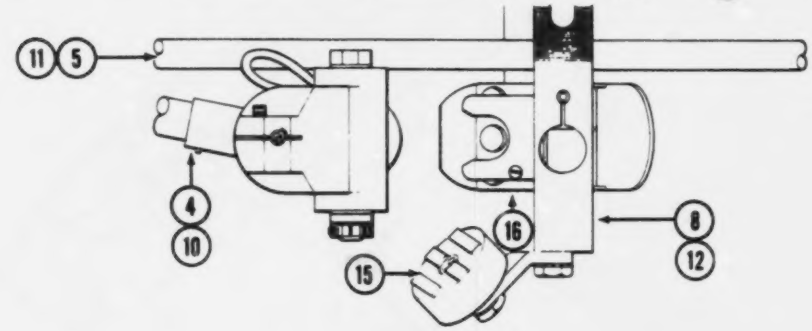
The electrical circuit interface will allow jettison of the inboard stores if only two missile launch tubes are installed on the outboard racks.

209075-409

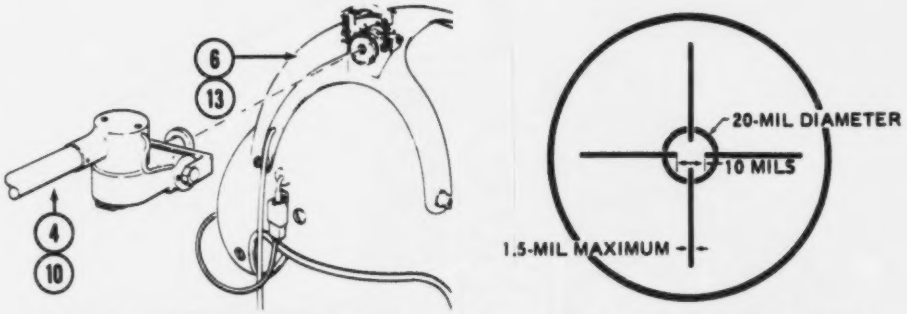
Figure 4-8. Wing Stores Jettison


1
2
3
4
5
6
7
8
9
10
11
12
13
14

HELMET SIGHT SUBSYSTEM


11
5
4
10
16
15
8
12

PILOT/GUNNER LINKAGE ARM ATTACHMENT TO BIT MAGNET AND STOW BRACKET


6
13
4
10
20-MIL DIAMETER
10 MILS
1.5-MIL MAXIMUM

PILOT/GUNNER LINKAGE ARM ATTACHMENT TO HELMET SIGHT

PILOT/GUNNER EYEPIECE RETICLE PATTERN

209071-344A

1. Electronic interface assembly
2. Gunner extension cable
3. Pilot linkage cable
4. Pilot linkage arm
5. Pilot linkage rails
6. Pilot helmet sight
7. Pilot eyepiece
8. Pilot linkage front support
9. Gunner linkage cable
10. Gunner linkage arm
11. Gunner linkage rails
12. Gunner linkage front support
13. Gunner helmet sight
14. Gunner eyepiece
15. BIT magnet
16. Stow bracket

Figure 4-9. Helmet Sight Subsystem (HSS)

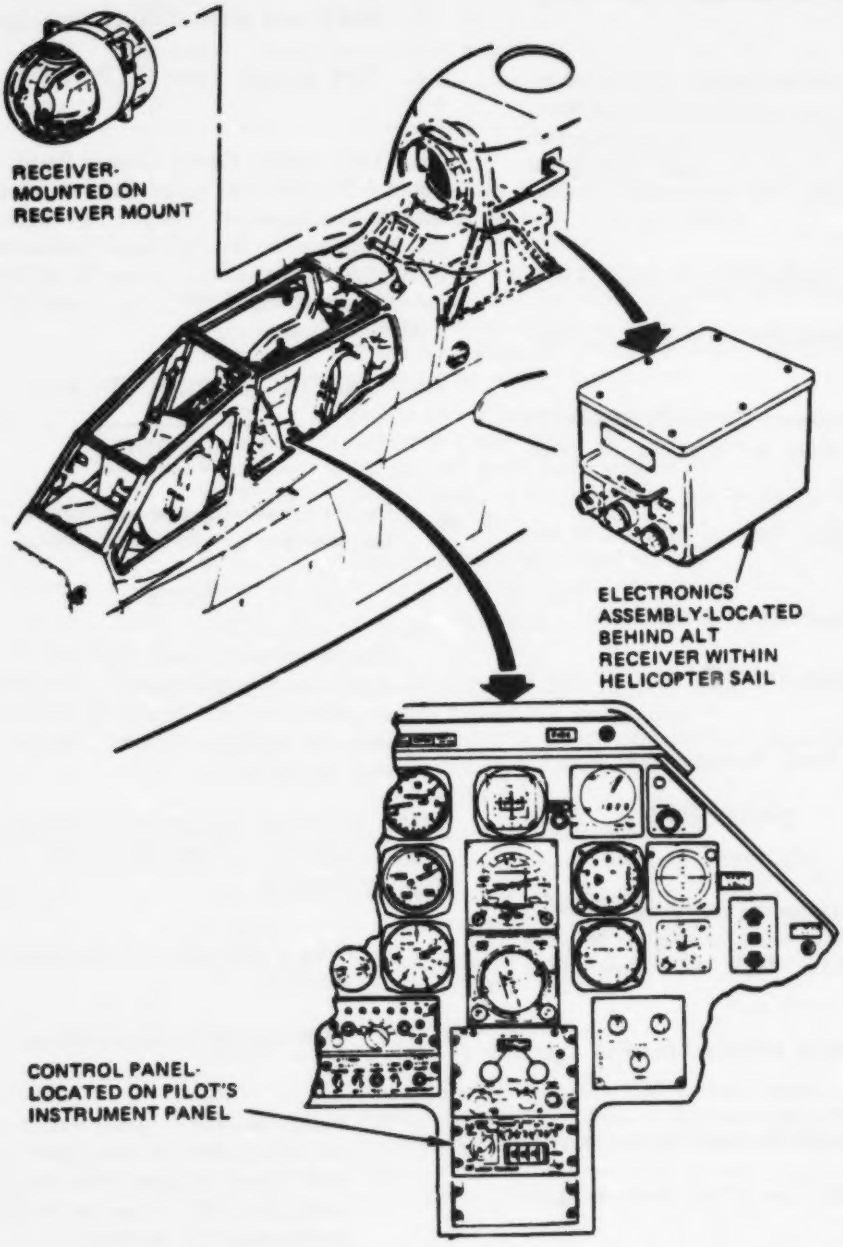

RECEIVER-
MOUNTED ON
RECEIVER MOUNT
ELECTRONICS
ASSEMBLY-LOCATED
BEHIND ALT
RECEIVER WITHIN
HELICOPTER SAIL
CONTROL PANEL-
LOCATED ON PILOT'S
INSTRUMENT PANEL
285-ALT-1

Figure 4-9.1 ALT Major Components - Helicopter Locations

a. Armament Control Panel. Refer to figure 4-10.

b. Recoil Compensation Switch Panel. The rotary switch provides variable recoil compensation feel as desired. Refer to figure 4-10.

c. Integrated Control and Display Unit. Refer to figure 4-11.

d. Wing Stores Jettison Switch. The guarded jettison switch is on the pilot collective stick switchbox. Activation of the switch will jettison the weapons from the inboard, outboard, or all four of the wing ejector racks. Refer to figure 4-8 for various jettison combinations.

e. Jettison Select Switch. Refer to figure 4-8.

f. Armament Circuit Breakers. Refer to figure 4-12.

g. Pilot Gunner Accuracy Control Panel (GACP) (Figure 4-13). Provisions are provided for panel installation.

h. Head Up Display. Refer to figures 4-14 and 4-15.

i. Pilot Helmet Sight. Refer to figure 4-9.

j. Cyclic Armament Switches. Refer to figure 2-13.

k. ALT Control Panel. Refer to figure 4-15.1.

4-8. GUNNER SWITCHES AND INDICATORS.

Gunner panels and switches are interfaced with other gunner/pilot panels and switches for weapon operations and wing stores jettison. Figure 4-3 shows switch interface.

a. Cyclic Armament Switches. Refer to figure 2-13.

b. Gunner Helmet Sight. Refer to figure 4-9.

c. Telescopic Sight Unit (TSU). Refer to figure 4-16.

d. Armament Control Panel. Refer to figure 4-17.

e. Wing Stores Jettison Switch. The guarded switch is on the gunner instrument panel. The switch is powered and protected by a toggle CB located with AC circuit breakers beneath pilot collective control stick. Refer to figure 4-8 for various jettison combinations.

f. Sight Hand Control (SHC). Refer to figure 4-18.

g. TOW Control Panel (TCP). Refer to figure 4-19.

h. Laser Range Finder Control Panel. Refer to figure 4-20. The laser range finder is used to find distance from helicopter to target. This range information is displayed on the TSU range readout and heads up display (HUD). Range information is also sent to the fire control computer (FCC) to be used for weapons trajectory calculations.

4-9. PREFLIGHT PROCEDURES.

WARNING

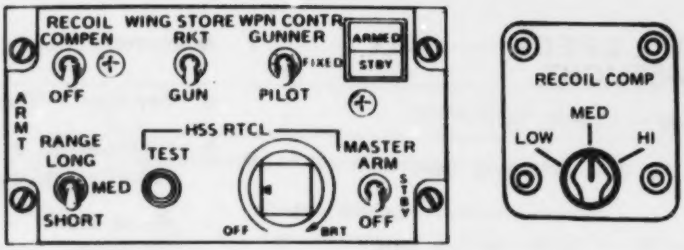
Do not rotate wing gun pod barrels. The machine gun will fire when rotated.

NOTE

Checks herein are only applicable if the armament is installed and are in addition to those listed in Chapter 8. Chapter 4 does not duplicate Chapter 8 checks except for safety.

4-10. BEFORE EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT SAFING PROCEDURES.

1. Wing ejector racks — Jetison safety pins installed.
2. TOW launcher — Missile arming lever up.
3. Rocket launcher — Igniter arms in contact with rockets. Rockets igniter arms must remain in contact with rockets to reduce possibility of ignition from EMI (electromagnetic interference).
4. MASTER ARM switch — OFF.
5. PLT ORIDE switch — OFF.



LOCATION PILOT INSTRUMENT PANEL

ITEM	FUNCTION
	WARNING **MASTER ARM switch bypassed when gunner plt oride switch in ORIDE.**
MASTER ARM Switch	OFF — Deactivates all sights (but HUD) and weapon control/firing circuits.
	STBY — Activates all sights (but HUD) turret, and TOW missile control circuits. Charges wing gun pod battery.
	ARM — Activates all sights (but HUD) and weapon control/firing circuits. Charges wing gun pod battery.
WPN CONTR Switch	PILOT — Permits pilot to fire turret using HS. Illuminates gunner PILOT IN CONT light.
	FIXED — Permits pilot to fire turret using HUD.
	GUNNER — Permits gunner to fire turret using helmet sight or TSU and TOW using TSU.
HSS RTCL OFF/BRT Switch	OFF — Deactivates pilot HS reticle lamps.
	Rotate — Varies intensity of pilot HS reticle lamps.
HSS RTCL TEST Switch	TEST — Tests pilot HS reticle.
ARMED/STBY Indicator	ARMED — Indicates MASTER ARM switch in ARM or gunner PLT ORIDE switch in PLT ORIDE (amber light).
	STBY — Indicates MASTER ARM switch in STBY (green light).
	OFF — Indicates MASTER ARM switch is off.
	Press — Tests indicator lights.
WING STORE Switch	RKT — Permits pilot or gunner to fire rockets.
	GUN — Permits pilot or gunner to fire wing mounted gun.
RECOIL Switch	OFF — Deactivates turret recoil compensation circuits.
	COMPEN — Activates turret recoil compensation circuits in SCAS.
RANGE Switch	LONG/ — Provides range to target data to turret elevation compensation circuits. LONG — 2000 m.
	MED/ — MED — 1500 m.
	SHORT — SHORT — 1000 m.
RECOIL COMP Switch	LOW — Provides low SCAS input to flight controls during turret fire.
	MED — Provides medium SCAS input to flight controls during turret fire.
	HI — Provides high SCAS input to flight controls during turret fire.

209075-435B

Figure 4-10. Pilot Armament Control Panel

4-11. EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT.

1. Turret right side — Check.
   a. Barrel clamp and retaining bolt — Secure.
   b. Gun mounting — Quick-release pins (ring up) installed through gun saddle holes and slider assembly, slider assembly secure on gun.
   c. Ammunition chute — Check condition and security.
   d. Feeder assembly — Check condition and security.
   e. Gun timing pin — Set.
   f. Feeder assembly timing pin — Set.
   g. Azimuth drive assembly — Check locking lever locked (down), condition and security.
2. Ammunition bay right side — Check.
   a. Bay door — Open.
   b. Ammunition box — Check condition, security, and quick-release pins.
   c. Boost motor — Check condition and security, electrical connector connected.
   d. Ammunition chute — Check condition, security, and ammunition present.
   e. Bay door — Close and secure.
3. Turret left side — Check.
   a. Gun mounting — Quick-release pins (ring up) installed through gun saddle holes and recoil adapter, recoil adapter secure on cradle.
   b. Elevation drive motor — Check condition and security, electrical connector connected. Locking lever down.

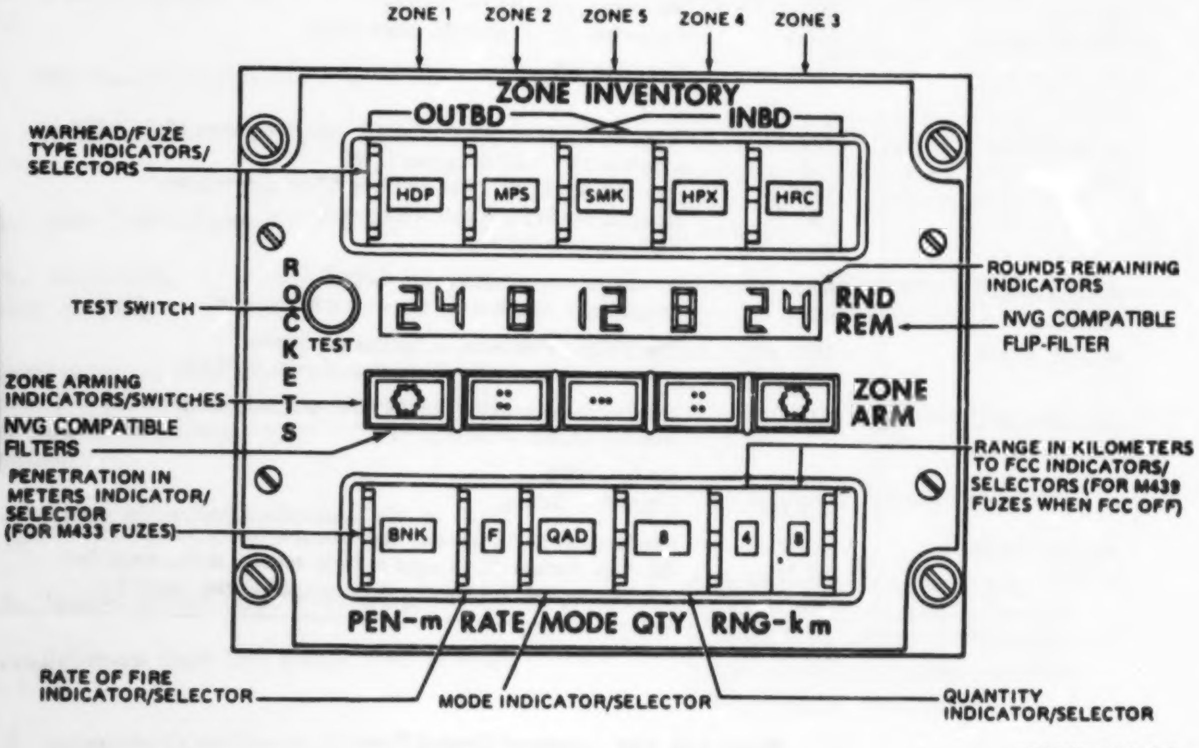

ZONE 1
ZONE 2
ZONE 5
ZONE 4
ZONE 3
ZONE INVENTORY
OUTBD
INBD
WARHEAD/FUZE TYPE INDICATORS/ SELECTORS
HDP
MPS
SMK
HPX
HRC
ROCKETS
TEST
TEST SWITCH
24 8 12 8 24
RND REM
ROUNDS REMAINING INDICATORS
NVG COMPATIBLE FLIP-FILTER
ZONE ARMING INDICATORS/SWITCHES
NVG COMPATIBLE FILTERS
ZONE ARM
RANGE IN KILOMETERS TO FCC INDICATORS/ SELECTORS (FOR M439 FUZES WHEN FCC OFF)
PENETRATION IN METERS INDICATOR/ SELECTOR (FOR M433 FUZES)
BNK
F
QAD
8
4
8
PEN-m
RATE
MODE
QTY
RNG-km
RATE OF FIRE INDICATOR/SELECTOR
MODE INDICATOR/SELECTOR
QUANTITY INDICATOR/SELECTOR
209071-393-1 B

Figure 4-11. Rocket Management System Display Unit (Sheet 1 of 3)

SELECTOR	FUNCTION
ZONE INVENTORY (Warhead/Fuze Type) Indicators/Selectors	Indicates type of round loaded in zone. CHF — Chaff warhead (countermeasures). MPS — Multi-purpose submunition/remote set fuses. SMK — Smoke screen/remote set fuses. ILM — Illumination/remote set fuses. FLC — Flechette—submunition/remote set fuses. H17 — 17 pound, high explosive, point detonating or proximity. WP — White phosphorous/point detonating. HDP — High explosive/dual purpose. HRC — High explosive/remote set fuses. HPX — High explosive/proximity. HPD — High explosive/point detonating. Blank — Special purpose, i.e. inert, target XM — marker, guided rocket, future E.W. countermeasure.
RND REM (Rounds Remaining Indicators)	Indicates functional rounds remaining in inventory by zone location.
TEST Switch	Tests digital display segment and indicator lamps (RND REM), and subsystem (including helicopter wiring) from end to end (excluding firing circuits).
ZONE ARM (Zone Arming) Indicator/Switches	Pressing appropriate ZONE ARM switch arms selected zone. When any one zone is selected (armed) all other zones with identical rounds are automatically armed and visually indicated by appropriate ZONE ARM switch(es). Any round selected by pressing a ZONE ARM switch, which is different (different zone) will automatically de-arm previously selected zone(s).
PEN-M (Penetration In Meters) Indicator/Selector	Permits pilot to select tree height range detonation (in five meter increments), superquick detonation or bunker penetration detonation. 45 — 40 — 35 — 30 — 25 — 20 — 15 — 10 — } Canopy height in meters. Enables round to penetrate canopy of forest or building and detonate at more effective point. BNK — Bunker penetration — to defeat bunkers (logs and dirt) up to 3 meters thick. SQ — Superquick — detonates when fuze makes contact with any object.

209071-393-2B

Figure 4-11. Rocket Management System Display Unit (Sheet 2 of 3)

SELECTOR	FUNCTION
RATE Indicator/Selector	F — Fast, fires rockets at 60 plus or minus 6 millisecond intervals. S — Slow, fires rockets at 180 plus or minus 18 millisecond intervals. A — Automatic, enables system to set firing interval from predetermined rates that would be programmed for each type of rocket/fuze combination that is available for selection.
MODE Indicator Selector	QAD — Quad fire of four rounds, one from each launcher with inboard rounds leading outboard rounds by 30 milliseconds. PRS — Pair firing of two rounds, one from each side of helicopter from zone that has been armed. SNG — Single fire of one round, alternating from side to side of helicopter.
QTY (Quantity) Indicator/Selector	Selects quantity of rockets to be fired and are a mulitple of the MODE indicator/selector setting. ALL — Sustained or continuous fire of all rounds selected. 8 — 8 x MODE setting of rounds selected. 4 — 4 x MODE setting of rounds selected. 2 — 2 x MODE setting of rounds selected. 1 — 1 x MODE setting of rounds selected.
RNG — km (Range In Kilometers) Indicators/Selectors	Selects range to target from 500 to 6000 meters in 100 meter increments for rocket ballistic solution when A is not selected. Left Indicator/Selector: Numerals — Selects 1000 meter position. A — Allows range from laser range finder to be used by FCC for ballistic solution and time of function data to be accepted by RMS from FCC. NOTE **If A is selected and no FCC range data is provided, the remote set fuze will detonate at 3000 meters.** Right Indicator/Selector: Numerals — Selects 100 meter position. Any ranges selected less than 500 meters (0.5) will only provide 500 meter range settings.

209071-393-3B

Figure 4-11. Rocket Management System Display Unit (Sheet 3 of 3)

c. Gun drive assembly — Check condition and security, electrical connector connected.

d. Telescopic sight unit—Cover removed and window clean. Perform turret stowed check.

4. Ammunition bay left side — Check.

a. Bay door — Open.

b. Ammunition box — Check condition, security, and quick-release pins.

c. Ammunition chute — Check condition, security, and ammunition present.

d. Electrical cables/connectors — Check condition and security.

e. LCHR BORESIGHT switch — OFF.

f. Bay door — Close and secure.

(O) 5. TOW — Check.

a. Launcher mounting — Check upper launcher aft and forward adjustable bomb lugs secure to helicopter ejector racks and rack swaybrace bolts firmly against launcher swaybrace pads. Lower launcher aft and forward attaching points secure to upper launcher aft and forward attaching points.

b. Electrical connector — Check upper launcher harness connected to helicopter receptacle and jettison quick disconnect lanyard attached to harness and launcher. Lower launcher harness connected to upper launcher harness receptacle.

c. Missile installation — Check missile front ring seated in forward tube mating ring, hinged center gate and debris director secure with captive locking pins. Note number of and position of installed missiles (needed for interior check).

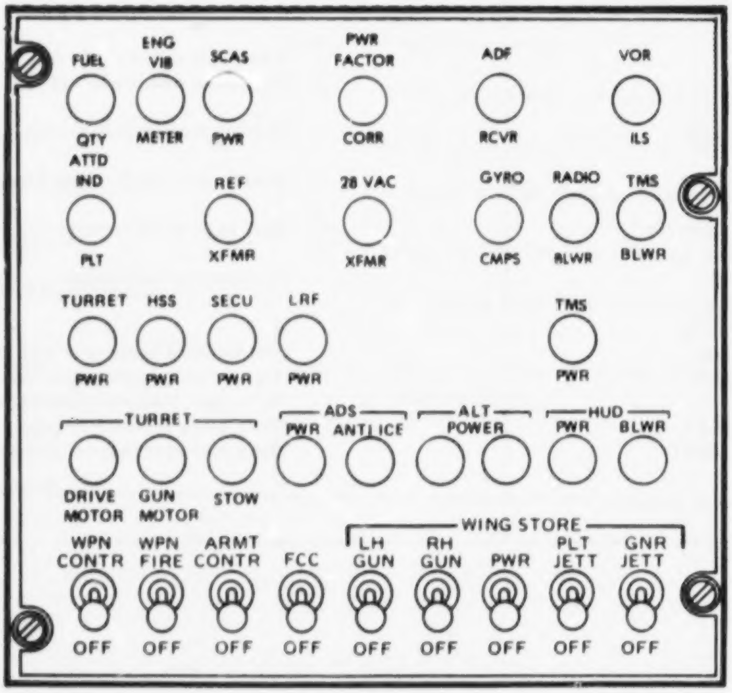

FUEL
QTY
ENG
VIB
METER
SCAS
PWR
PWR
FACTOR
CORR
ADF
RCVR
VOR
ILS
ATTD
IND
PLT
REF
XFMR
28 VAC
XFMR
GYRO
CMPS
RADIO
BLWR
TMS
BLWR
TURRET
PWR
HSS
PWR
SECU
PWR
LRF
PWR
TMS
PWR
TURRET
DRIVE
MOTOR
GUN
MOTOR
STOW
ADS
PWR
ANTI ICE
ALT
POWER
HUD
PWR
BLWR
WING STORE
WPN
CONTR
WPN
FIRE
ARMT
CONTR
FCC
LH
GUN
RH
GUN
PWR
PLT
JETT
GNR
JETT
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF
OFF

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Figure 4-12. Pilot Armament Circuit Breakers (Sheet 1 of 2)

CIRCUIT BREAKER	FUNCTION — Applies Power to and Protects Circuit for
REF XFMR	Reference transformer.
TMS BLWR	TOW missile system blower.
TURRET PWR	Turret power.
HSS PWR	Helmet sight subsystem power.
SECU PWR	Servo electronic control unit power.
LRF PWR	Laser rangefinder power.
TMS PWR	TOW missile system power.
TURRET	
DRIVE MOTOR	Turret drive motor.
GUN MOTOR	Turret gun motor.
STOW	Turret stow control.
ADS	
PWR	Air data subsystem power.
ANTI ICE	Air data subsystem anti ice.
ALT	
POWER	Airborne laser tracker power.
HUD	
PWR	Heads up display power.
BLWR	Heads up display blower.
WPN CONTR	Master arm switch standby power.
WPN FIRE	Master arm switch fire power.
ARMT CONTR	Gun control assembly.
FCC	Fire control computer.
WING STORE	
LH GUN	Left inboard wing gun pod firing.
RH GUN	Right inboard wing gun pod firing.
PWR	Left/right inboard/outboard rocket firing.
PLT JETT	Wing store jettison — pilot.
GNR JETT	Wing store jettison — gunner.

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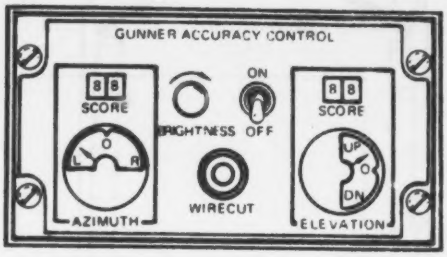
Figure 4-12. Pilot Armament Circuit Breakers (Sheet 2 of 2)


GUNNER ACCURACY CONTROL
88
SCORE
BRIGHTNESS
ON
OFF
88
SCORE
L
O
R
AZIMUTH
WIRECUT
UP
O
DN
ELEVATION

LOCATION: PILOT INSTRUMENT PANEL IF INSTALLED

ITEM	FUNCTION
ON/OFF Switch	ON — Activates gunner accuracy control circuits. — Performs built-in-test of circuits. Circuits pass test if AZIMUTH/ELEVATION SCORE indicators display 55 ± 5. OFF — Deactivates circuits.
WIRE CUT Switch	Press — Resets indicators and deactivates camera.
AZIMUTH Indicator	— Displays TSU azimuth line-of-sight.
AZIMUTH SCORE Indicator	— Displays gunner final azimuth score.
ELEVATION Indicator	— Displays TSU elevation line-of-sight.
ELEVATION SCORE Indicator	— Displays gunner final elevation score.
BRIGHTNESS Knob	Turn — Varies intensity of AZIMUTH/ELEVATION SCORE indicator lights.

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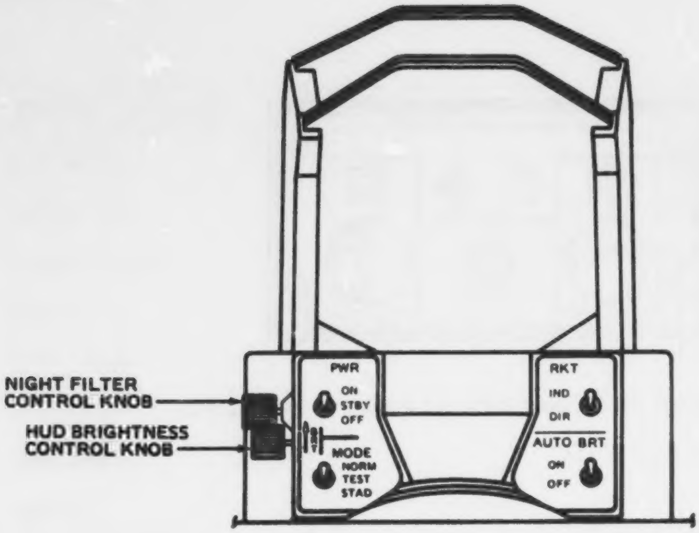
Figure 4-13. Gunner Accuracy Control Panel (GACP)



ITEM	FUNCTION
PWR Switch	
ON	Electrical power applied, symbols displayed depend on MODE switch position.
STBY	Electrical power applied, no symbols displayed.
OFF	All electrical power removed from HUD circuits.
MODE Switch	
NORM	Displays basic symbols according to firing mode selected.
TEST	Displays all heads up display symbols except the stadiametric reticle.
STAD	Displays stadiametric reticle which is a backup reticle.
RKT Switch	
IND	Displays a continually computed rocket release point.
DIR	Displays a continuously computed rocket impact point.
AUTO BRT Switch	
ON	Allows brightness of displayed symbols to be automatically adjusted.
OFF	Disables automatic brightness control feature.
	CAUTION **Do not leave in night filter position in sunlight. Sunlight will damage the night filter beyond repair.**
NIGHT FILTER Control Knob	Selects usage of night filter by rotating knob.
HUD BRIGHTNESS Control Knob	Controls brightness of heads up display element when rotated as shown by BRIGHT arrow.

209871-1B

Figure 4-14. Head Up Display

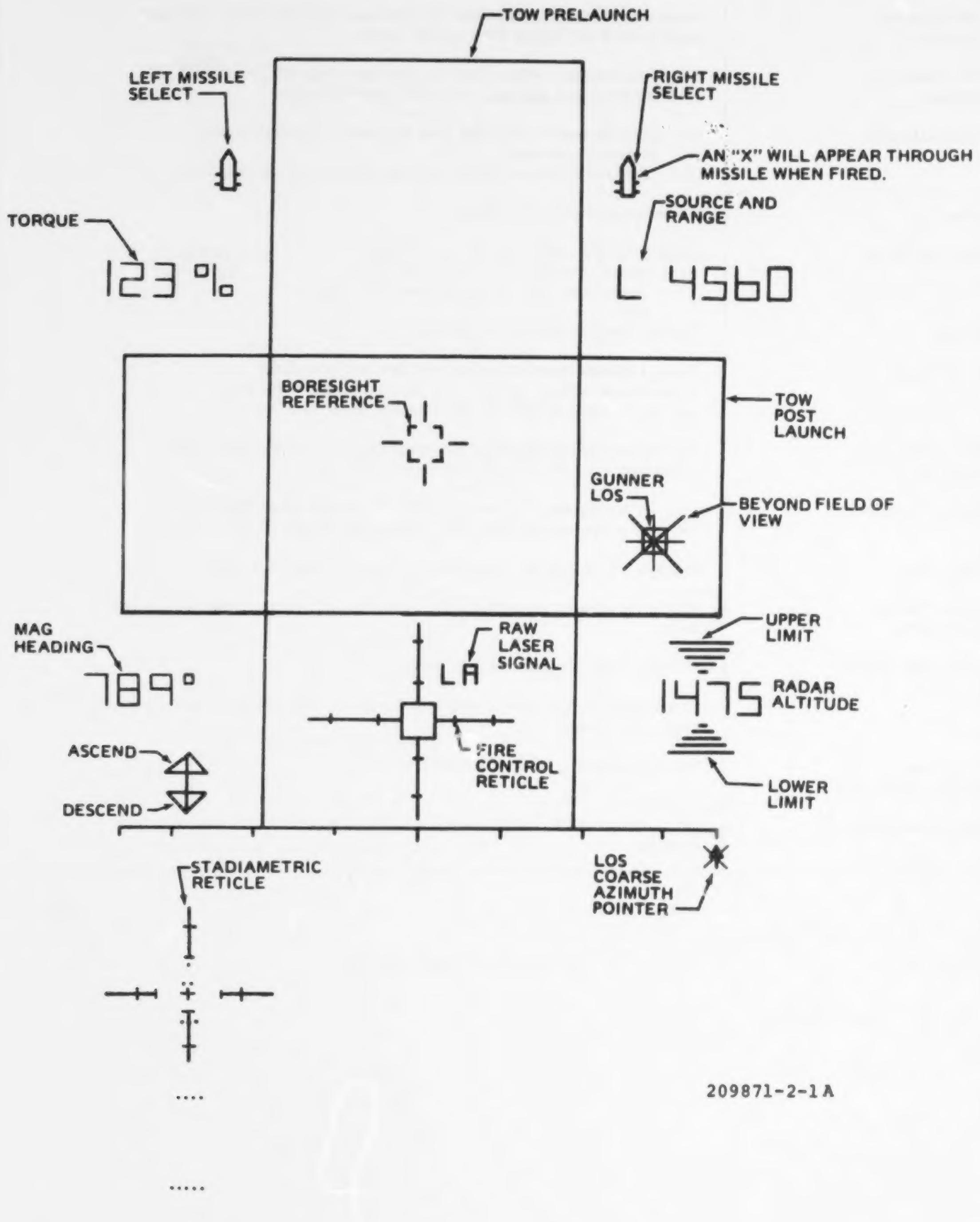

TOW PRELAUNCH
LEFT MISSILE SELECT
RIGHT MISSILE SELECT
AN "X" WILL APPEAR THROUGH MISSILE WHEN FIRED.
TORQUE
SOURCE AND RANGE
123 %
L 4560
BORESIGHT REFERENCE
TOW POST LAUNCH
GUNNER LOS
BEYOND FIELD OF VIEW
MAG HEADING
RAW LASER SIGNAL
LA
UPPER LIMIT
789°
1475
RADAR ALTITUDE
ASCEND
DESCEND
FIRE CONTROL RETICLE
LOWER LIMIT
STADIAMETRIC RETICLE
LOS COARSE AZIMUTH POINTER
209871-2-1 A

Figure 4-15. Head Up Display (HUD) Symbols (Sheet 1 of 3)

SYMBOL	FUNCTION
Missile Select	Indicates TOW missile selected for firing from left or right launcher.
TOW Prelaunch Constraint	Represents boundary within which the pilot must keep the gunner LOS and target prior to and during TOW missile launch.
TOW Postlaunch Constriant	Represents boundary within which the pilot must keep the gunner LOS after TOW missile launch and until wire cut or missile impact.
Ascend—Descend	ON - Indicates nose of helicopter must be raised or lowered to meet prelaunch constraints. OFF - Indicates helicopter attitude and line-of-sight rate are compatible.
Torque	Indicates engine torque in percent.
Source and Range	Displays range in meters and source of range: F — Range from fire control computer (FCC). L — Range from laser (displayed when FCC fails).
Heading	Displays magnetic heading of helicopter.
Radar Altitude	Displays altitude above ground level in five feet increments. When absolute altitude exceeds 1495 feet, the numbers will blank and will not unblank until the altitude drops below 1475 feet.
Upper Limit — Lower Limit	Illuminates when within 25 feet of present upper or lower altitude limits selected on AN/APN-209 radar altimeter.
Boresight Reference	Used for boresighting weapons and serves as aircraft datum line (ADL) reference symbol during flight. It is used during indirect firing of rockets.
Gunner LOS	Displays line of sight as commanded by telescopic sight unit (TSU).
Beyond Field of View Caution	An X superimposed on gunner LOS to indicate LOS has exceeded field of view limits.
Fire Control Reticle	Indicates target area for rocketing firing.
LA	Superimposes on fire control recticle and indicates FCC has failed and raw laser range is being used.
LOS Coarse Azimuth Pointer	Indicates azimuth reading of gunner TSU LOS.
Stadiametric Reticle	Displays when HUD MODE switch is in STAD position and is used as a back up reticle.

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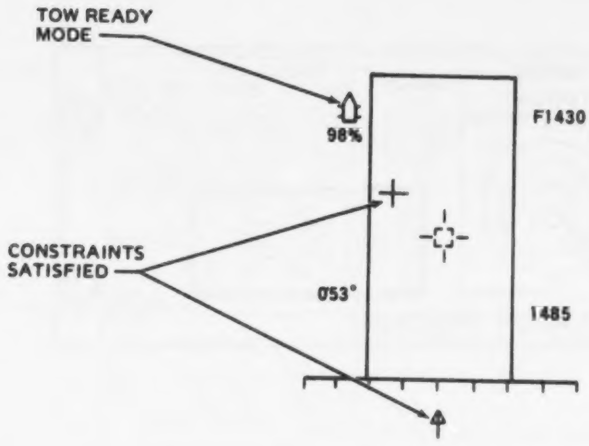
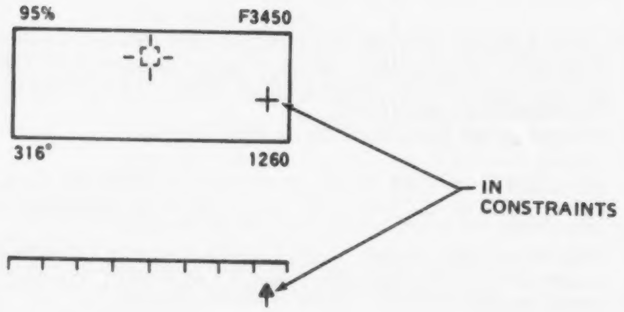
Figure 4-15. Head Up Display (HUD) Symbols (Sheet 2 of 3)


TOW READY MODE
98%
F1430
CONSTRAINTS SATISFIED
053°
1485

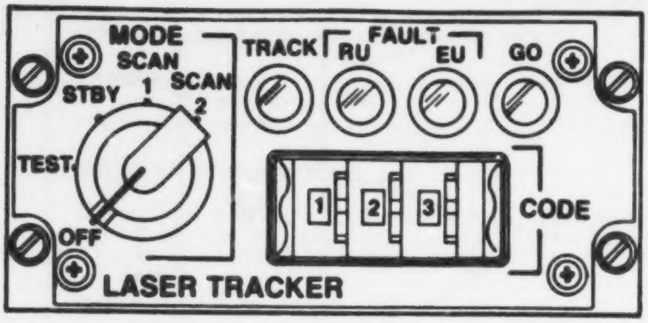
PRELAUNCH CONSTRAINTS


95%
F3450
316°
1260
IN CONSTRAINTS

POSTLAUNCH CONSTRAINTS

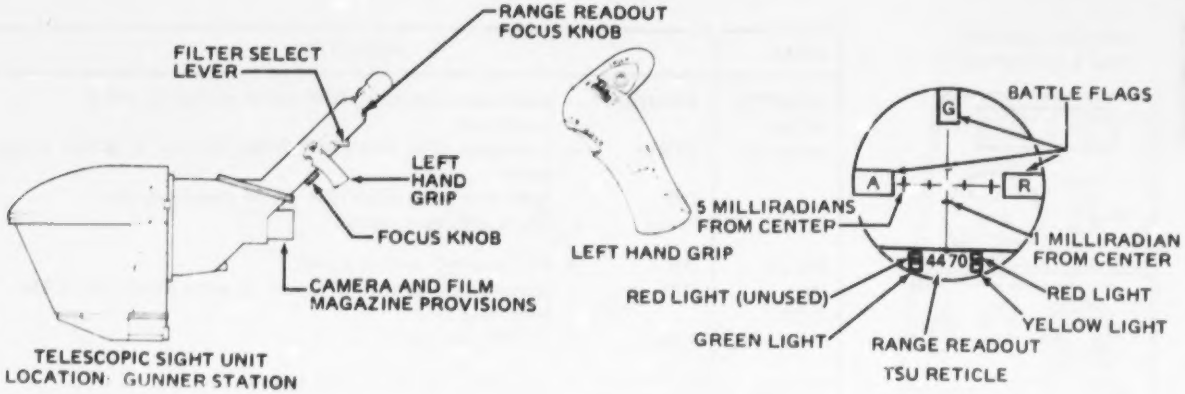
209871-2-3A

Figure 4-15. Head Up Display (HUD) Symbols (Sheet 3 of 3)



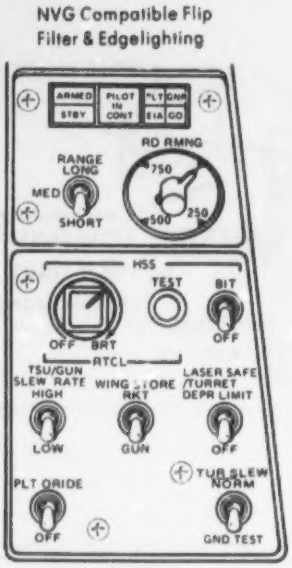
ITEM	FUNCTION
MODE SWITCH	OFF-TURNS ALT POWER OFF (TRACKER GIMBALS ARE FREE TO MOVE). TEST-STARTS ALT SELF-TEST. STBY-CENTERS ALT OPTICS (ALT READY TO SCAN). SCAN 1-SCANS 0 TO -8.3 DEGREES ELEVATION AND ± 15 DEGREES AZIMUTH. SCAN 2-SCANS 0 TO -25 DEGREES ELEVATION,AND ± 60 DEGREES AZIMUTH.
TRACK LAMP	LIGHTS WHEN SYSTEM ACQUIRES A REFLECTED LASER SIGNAL FROM TARGET. SYSTEM MUST BE IN SCAN 1 OR SCAN 2 MODE. REFLECTED LASER SIGNAL CODE MUST MATCH CODE SELECTED AT CODE THUMBWHEEL SWITCHES. TRACK LAMP ALSO LIGHTS IN TEST MODE.
FAULT LAMPS	RU- LIGHTS IN TEST MODE IF RECEIVER IS DEFECTIVE. EU- LIGHTS IN TEST MODE IF ELECTRONICS ASSEMBLY IS DEFECTIVE.
GO LAMP	LIGHTS IN TEST MODE IF SELF-TEST IS GOOD. LIGHTS WITH TRACK LAMP AFTER 25 SECONDS. THE GO LAMP WILL TURN OFF AGAIN AFTER 30 SECONDS.
CODE THUMBWHEEL SWITCH	SELECTS A CODED 3 DIGIT NUMBER THAT MATCHES CODE OF TARGET'S LASER SIGNAL.

Figure 4-15.1 ALT Control Panel


RANGE READOUT FOCUS KNOB
FILTER SELECT LEVER
LEFT HAND GRIP
FOCUS KNOB
CAMERA AND FILM MAGAZINE PROVISIONS
TELESCOPIC SIGHT UNIT
LOCATION: GUNNER STATION
LEFT HAND GRIP
BATTLE FLAGS
G
A
R
5 MILLIRADIANS FROM CENTER
1 MILLIRADIAN FROM CENTER
4470
RED LIGHT (UNUSED)
RED LIGHT
YELLOW LIGHT
GREEN LIGHT
RANGE READOUT
TSU RETICLE

ITEM	FUNCTION
Left-hand grip switches	
MAG switch	LO — Magnifies target two times. HI — Magnifies target 13 times.
TRIGGER switch	—Fires TOW if selected in first or second detent. — Fires turret if selected in First Detent — Limited to 16 round burst. Second Detent — Continuous burst.
ACTION switch	— Activates TOW launchers. — Slaves turret to TSU or gunner helmet sight.
LASER switch	— Fires laser pulses at target for range finding.
TSU Reticle	
G battle flag	— When flashing, indicates TCP MODE SELECT switch is TSU/GUN position and turret not aligned with TSU. — When steady, indicates TCP MODE SELECT switch is in TSU/GUN position and turret is aligned with TSU.
A battle flag	— Indicates TCP MODE SELECT switch is in the ARMED position. All requirements have been met except prelaunch constraints.
R battle flag	— Indicates pilot has achieved prelaunch constraints for TOW firing.
Red light	— Indicates no-valid laser return pulse
Green light	— Indicates multiple targets detected by laser range finder.
Yellow light	Steady — Indicates laser range finder malfunction. Flashing — Indicates laser range finder overtemperature.
Range readout	— Indicates range from helicopter to target.
Filter select lever	— Selects filters of different light intensities. Red: Use when firing a TOW missile to reduce glare from the IR source on the missile and thus allow proper tracking of the target. Clear: To be used during low light level conditions, such as hazy (smoke, fog, dust) days or under twilight conditions. Neutral Density: To be used on bright clear days or to reduce the glare reflected from bodies of water. Laser Filter: To be used during any laser ranging operations to protect the eyes from laser radiation energy.
Range readout focus knob	— Focus battle and range readout display.
Focus knob	— Focus target image.

Figure 4-16. Gunner Telescopic Sight Unit (TSU)



LOCATION: GUNNER RIGHT CONSOLE

ITEM	FUNCTION	
ARMED/ STBY Indicator	ARMED	— Indicates pilot MASTER ARM switch in ARM (red light).
	STBY	— Indicates pilot MASTER ARM switch in STBY (green light).
	Off	— Indicates pilot MASTER ARM switch is OFF.
	Press	— Tests indicator lights.
PILOT IN CONT Indicator	ON	— Pilot has control of turret.
	OFF	— Gunner has control of turret or pilot MASTER ARM switch is OFF.
	Press	— Tests indicator light.
PLT/ GNR/ EIA/ GO Indicators	PLT	— Indicates failure in pilot helmet linkage.
	GNR	— Indicates failure in gunner helmet linkage.
	EIA	— Indicates failure in electronic interface assembly.
	GO	— Indicates HSS operating properly.
	Press	— Tests indicator lights.
	Off	— Indicates HSS built-in-test not being conducted.
RANGE Switch	SHORT/	— Provides target range data to compensation circuit. Short — 1000 m.
	MED/	— Med — 1500 m.
	LONG	— Long — 2000 m.
RD RMNG Counter	Gradations	— Indicates quantity of ammunition remaining for turret weapon.

ITEM	FUNCTION	
HSS RETICLE OFF/BRT Switch	OFF	— Deactivates gunner HSS reticle lights. Varies intensity of gunner HSS reticle lights when turned.
HSS RTCL TEST Switch	TEST	— Tests gunner HSS reticle.
HSS BIT Switch	OFF	— Deactivates pilot and gunner HSS built-in test circuit.
	BIT	— Tests pilot and gunner HSS when linkage arms attached to BIT magnets.
TSU/GUN SLEW RATE Switch	HIGH	— Selects high slew rate for TSU when the TOW control panel mode select switch is in the TSU/GUN position.
	LOW	— Used for more accurate firing by engaging circuit so TSU will move at TOW mode - Hi MAG slew rate.
WING STORE Switch	RKT	— Permits gunner to fire rockets.
	GUN	— Permits gunner to fire wing mounted gun.

ITEM	FUNCTION	
LASER SAFE/ TURRET DEPR LIMIT Switch	OFF	— Permits turret travel between minimum to maximum elevation.
	LASER SAFE/ TURRET DEPR LIMIT	— Limits downward travel to prevent turret weapon from striking ground and prevents laser from firing.
PLT ORIDE Switch	OFF	— Permits pilot armament control panel to control the weapons.
	PLT ORIDE	— Overrides pilot armament control panel. Permits gunner to fire turret using HSS, and wing stores (not TOW) without sight. Deactivates TSU left hand grip trigger
TUR SLEW Switch	NORM	— Drives turret azimuth and elevation at 60 degrees per second.
	GND TEST	— Used for ground operations servicing only (drives turret azimuth and elevation at 4 to 8 degrees per second).

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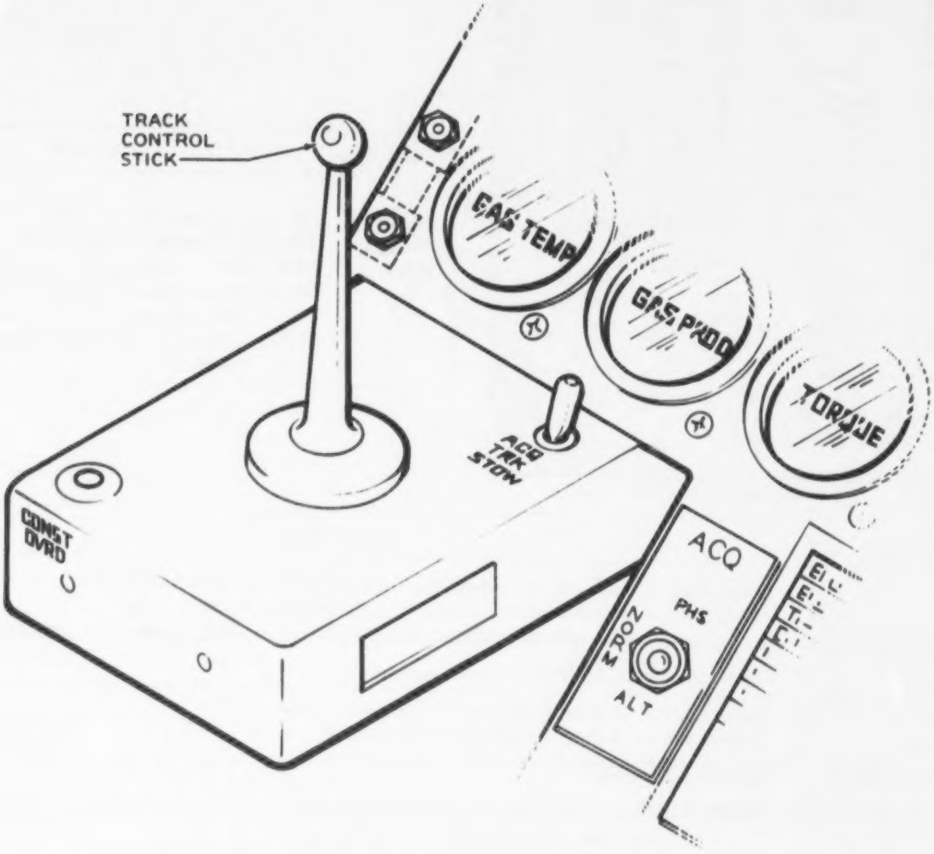
Figure 4-17. Gunner Armament Control Panel

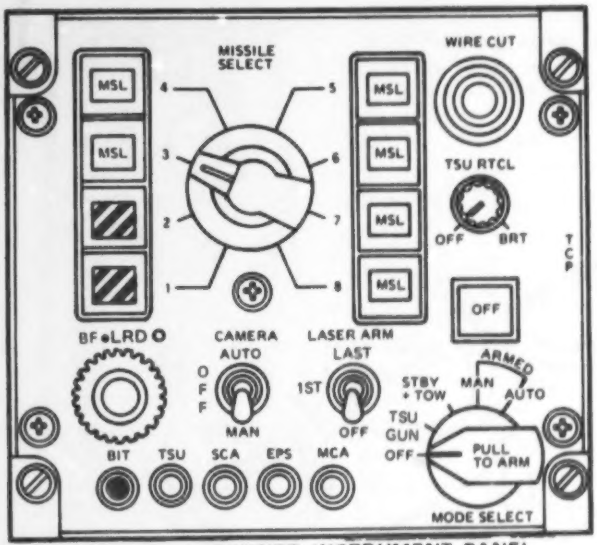

TRACK
CONTROL
STICK
GAS TEMP
GAS PROD
TORQUE
ACQ
TRK
STOW
CONST
OVRD
ACQ
PHS
NORM
ALT

LOCATION: GUNNER INSTRUMENT PANEL

ITEM	FUNCTION
Track Control Stick	Positions TSU in azimuth and elevation.
ACQ/TRK/STOW Switch	ACQ — Slaves TSU to gunner HS for target acquisition. TRK — Permits track control handle to position TSU. STOW — Stows TSU dead-ahead.
ACQ Switch Located on Instrument Panel	NORM — Track control stick controls TSU. PHS — Slaves TSU to PHS when mode switch is in track. ALT — Slaves TSU to ALT.
CONST OVRD Switch	Permits TOW firing when helicopter is not within the prelaunch constraints when pressed.

209071-350C

Figure 4-18. Gunner Sight Hand Control (SHC)



LOCATION: GUNNER INSTRUMENT PANEL

ITEM	FUNCTION
MODE SELECT Switch	Off - Deactivates TSU and TMS circuits. TSU/GUN - Selects turret operation for gunner. STBY TOW - Permits gunner to control TMS. MAN - Permits gunner to select missile to be fired manually. AUTO - Missile to be fired is automatically selected.

ITEM	FUNCTION
TSU/SCA/ EPS/MCA Unit Fail Indicators	Black Flag — Indicates unit operational during performance or built-in-test. White Flag — Indicates unit failure during performance or built-in-test. EPS indicates failure during performance, built-in-test, or nonperformance.
BIT Switch	Performs manual built-in-test when pressed.
BF Knob LRD Knob	Inner Knob — Adjusts brightness of TSU battle flags. Outer Knob — Adjusts brightness of TSU range readout.
CAMERA Switch	Not normally used:
LASER ARM Switch	FIRST — Allows laser range finder to compute target distance by using first laser pulse reflected from target. LAST — Allows laser range finder to compute target distance by using last laser pulse reflected from target. OFF — Deactivates laser range finder.
OFF/PWR/ON/ ARMED/TEST System Status Annuciator	OFF — Indicates MODE SELECT switch is in the OFF position. PWR ON — Indicates MODE SELECT switch is in the TSU GUN or STBY TOW position. ARMED — Indicates MODE SELECT switch is in the ARMED position. TEST — Indicates built-in-test is being performed.
TSU RTCL Switch	OFF — Deactivates the TSU reticle circuit. Varies intensity of TSU reticle lights when turned.
WIRE CUT Switch	Permits gunner to manual cut missile command wire when pressed.
MSL/Barberpole Missile Status Indicators	MSL — Indicates missile is present in a specific location of launcher. Barberpole — Indicates missile is not present in a specific location of launcher.
MISSILE SELECT Switch	1/2/3/4/ 5/6/7/8 — Indicates missile selected (manual or automatic) for firing.

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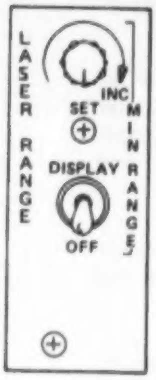
Figure 4-19. Gunner TOW Control Panel (TCP)


LASER RANGE
INC
SET
MIN RANGE
DISPLAY
OFF

ITEM	FUNCTION
MIN RANGE SET knob	Sets minimum range which laser range finder will recognize.
DISPLAY switch DISPLAY	Displays minimum range in eye piece display in TSU and resets normal range to zero.
OFF	Deactivates minimum range display circuit and permits normal range display.

209075-401

Figure 4-20. Laser Range Finder Control Panel

(O) 6. Rocket launcher — Check.

   a. Launcher mounting — Check launcher aft and forward bomb suspension lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against launcher but not denting exterior.

   b. Electrical connection — Check harness connected to launcher and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and launcher.

   c. Launcher — Check launcher exterior and tube interiors for damage and corrosion.

   d. Rocket installation — Check rocket aft end secure in launcher tube aft detent.

   e. Igniter arms — Check for damage and corrosion.

(O) 7. Wing gun pod — Check.

   a. Front fairing — Removed.

   b. Bullet trap — Installed.

   c. Pod mounting — Check pod front and rear lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against pod but not denting exterior.

   d. Electrical connection — Check harness connected to pod and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and pod.

   e. Pod — Check pod exterior for condition (includes front fairing removed during step a).

   f. Gun barrel clamp and retaining bolt — Check secure.

   g. Gun mounting — Check recoil adapters, quick release pins, and rear mount secure.

   h. Gun gate solenoid — Check plunger returns to extended position when pressed, electrical connectors condition and security.

   i. Gun exit unit — Check condition and security.

   j. Gun feeder wheel — Check condition and security.

   k. Gun electrical drive — Check drive and electrical connectors condition and security.

   l. Gun safing sector — Secure.

   m. Gun round counters (2) — Set.

   n. Gun timing pin — Set.

   o. Gun feeding timing pin — Set.

   p. Gun exit unit timing pin — Set.

   q. Rear fairing — Remove.

   r. CHGR switch — AUTO.

   s. HTR switch — As desired.

(O) t. Firing RATE selector switch — As desired.

(O) u. FLD power start switch — BAT.

   v. Battery — Check for damage, leaking cells, and corrosion.

   w. Rear fairing — Replace and secure.

   x. Bullet trap — Remove.

   y. Front fairing — Replace and secure.

4-12. BEFORE STARTING ENGINE CHECK.

NOTE

Check is to be performed after BEFORE STARTING ENGINE, Chapter 8.

1. Armament switches — Set.

   a. Gunner SHC ACQ/TRK/STOW switch — STOW.

   b. Gunner TCP MODE SELECT switch — OFF, system status annunciator displays OFF.

c. Gunner TCP CAMERA switch — OFF

d. Gunner TCP LASER ARM switch — OFF.

e. Gunner TCP TSU RTCL switch — OFF.

f. Gunner TCP MISSILE SELECT switch—As desired.

g. Gunner RD RMNG indicator/selector — Set.

h. TUR SLEW switch — NORM.

4-13. ARMAMENT — SYSTEMS CHECK.

WARNING

The following checks shall not be performed with TOW missiles installed.

1. HSS built-in-test—Check.

a. Pilot and gunner HS arm assemblies — Attached to BIT magnets.

b. Pilot MASTER ARM switch — STBY.

c. Pilot WPN CONTR switch — GUNNER.

d. Indicator light test — Press pilot and gunner ARMED/STDY, gunner PILOT IN CONT and PLT/GNR/EIA/GO panels. All sections illuminate.

e. Gunner HSS BIT switch — BIT. Test passed if GO light illuminates, failed if PLT/GNR/EIA lights illuminate. If failed, ensure HSS arm assemblies are properly attached to BIT magnets, check all cable connections, and press BIT switch again.

NOTE

If failure occurs, recycle MASTER ARM switch and do not use failed station.

2. HSS to turret — Check.

a. Pilot and gunner HS arm assemblies — Attach to helmet.

b. Pilot and gunner HS eyepieces — Extended over eye.

c. Gunner reticle — Adjust, focus, and test lights. HSS RTCL OFF BRT control to be in full BRT. After adjust and focus, press HSS RTCL TEST switch. If reticle goes out, one or more lights may have failed. Release TEST switch.

CAUTION

Do not drive turret to stops during this check.

d. Gunner HS to turret check — TSU left hand grip ACTION switch pressed, gunner moves head, turret follows head movement. Gunner makes rapid rotational head movement, reticle flashes until gun line is coincident with HS line. Release ACTION switch.

WARNING

In the following check, do not press the gunner cyclic GUN switch.

e. Gunner emergency mode check — Gunner PLT ORIDE switch in ORIDE and cyclic ACTION switch pressed, repeat step d. above, then PLT ORIDE switch to OFF.

f. Pilot WPN CONTR switch — PILOT. Pilot reticle — Adjust, focus, and test lights. HSS RTCL OFF BRT control to be in full BRT. After adjust and focus, press HSS RTCL TEST switch. If reticle goes out, one or more lights may have failed. Release TEST switch.

g. Pilot HS to turret check — Cyclic ACTION switch pressed, pilot moves head, turret follows head movement. Pilot makes rapid rotational head movement, reticle flashes until gun line is coincident with HS line. Release ACTION switch.

3. TOW built-in-test — Check.

a. Pilot WPN CONTR switch — GUNNER.

b. Gunner TCP MODE SELECT switch — STBY TOW, system status indicator moves from OFF to TEST after approximately 10 seconds. Indicator moves from TEST to PWR ON within 120 seconds. TSU/SCA/EPS/MCA fail indicators display black flags. Black flag indicates automatic BIT passed, white flag indicates failure.

c. Gunner TCP BIT switch — Hold, gunner TSU reticle A/G/R battle flags and HUD ascend/descend pointers displayed. Release switch. System will resequence BIT test.

d. Gunner TCP missile status indicators — Displays missile load configuration noted during exterior check.

e. TOW BIT (performed above) information. Automatic or manual BIT may be performed before, during, or after operations.

(1) TOW BIT initiation.

(a) Gunner SHC ACQ/TRK/STOW switch — STOW.

(b) Automatic BIT — Gunner TCP MODE SELECT switch from OFF to TSU/GUN or STBY TOW.

(c) Manual BIT — When gunner TCP system status annunciator displays PWR ON, press and release TCP BIT switch.

(2) TOW BIT termination.

(a) Automatic or manual BIT — Automatically completed within two minutes.

(b) Termination during BIT. Gunner SHC ACQ/TRK/STOW switch set to ACQ or TRK or TCP MODE SELECT switch set to MAN ARMED, AUTO ARMED, or OFF.

4. TSU fast rate tracking — Check.

a. Focus knob — Rotate counterclockwise to stop.

b. Gunner — Look into TSU eyepiece.

c. TCP MODE SELECT switch — STBY TOW.

d. SHC ACQ/TRK/STOW switch — TRK.

e. LHG MAG switch — HI. Switch must be positively held in position before releasing. TSU eyepiece displays high magnification (13 power) of target.

f. Focus knob — Rotate clockwise until focus is obtained.

g. LHG MAG switch — LO. Switch must be positively held in position before releasing. TSU eyepiece displays low magnification (two power) of target.

h. SHC track control stick — Move full left and down. TSU rapidly moves left and down.

i. SHC track control stick — Release. TSU view not rotating and pilot HUD LOS cuing symbol full left and down.

5. TSU slow rate tracking — Check.

a. Gunner — Look into TSU eyepiece during check.

b. TCP MODE SELECT switch — STBY TOW.

c. LHG MAG switch — HI. Switch must be positively held in position before releasing. TSU eyepiece displays high magnification (13 power) of target.

d. SHC track control stick — Move full right and up. TSU slowly moves right and up.

e. SHC track control stick — Release. TSU view not rotating.

6. TSU motion compensation — Check.

a. Gunner — Look into TSU eyepiece during check.

  - b. LHG ACTION switch — Press.
  - c. SHC track control stick — Move left and down. Release when TSU starts moving, TSU continue to move.
  - d. LHG ACTION switch — Release. TSU stops.

7. TSU stow position and reticle — Check.
  - a. Gunner — Look into TSU eyepiece during check.
  - b. TCP RTCL switch — Rotate. Reticle light intensity varies.
  - c. SHC ACQ/TRK/STOW switch — STOW. TSU returns to stow position.

8. HSS to TSU — Check.
  - a. Pilot and gunner HS eyepieces — Extended over eye.
  - b. Gunner HS reticle — On a target.
  - c. SHC ACQ/TRK/STOW switch — ACQ.
  - d. SHC ACQ/TRK/STOW switch — Released. Returns to TRK. Gunner HS eyepiece retracts.
  - e. TSU reticle — Displayed target.

f. Gunner HS eyepiece — Extended over eye.

g. Pilot HS reticle — On another target.

h. ACQ switch — PHS, switch must be held in position. Gunner HS eyepiece retracts.

i. ACQ switch — Released. Returns to NORM.

j. TSU reticle — Displays pilot target.

k. SHC ACQ/TRK/STOW switch - STOW.

l. TCP - TSU/GUNS.

9. RMS BIT — Check.

a. MASTER ARM switch — STBY.

b. Pilot TEST switch — Press. Test passed if during the first sequence all RND REM display segments display a lighted 8 indicating all segments operational, and if during second sequence a lighted 7 is displayed in all positions indicating all LRUs operational. During this check, ZONE ARM lights should illuminate.

10. Head-Up Display - Check should be as follows:

a. PWR Switch - STBY. Allow one-half minute for warm-up.

b. AUTO BRT Switch - off.

c. MODE Switch - Test.

d. MODE Switch - NORM.

e. PWR Switch - ON.

f. RKT Switch - DIR.

g. NIGHT FILTER CONTROL - Green for day time operation or red for night time operation.

h. HUD BRIGHTNESS CONTROL - Vary for desired brightness level.

i. AUTO BRT Switch - on.

11. ALT - Check.

a. Pilot INV circuit breaker - IN.

b. Pilot BATTERY switch - RUN.

c. Pilot ALT POWER (10 ampere) circuit breaker - IN.

d. Pilot ALT POWER (1 ampere) circuit breaker - IN.

e. Pilot WPN CONTR circuit breaker switch - ON.

f. Pilot ARMT CONTR circuit breaker switch - ON.

g. Pilot MASTER ARM switch - STANDBY.

h. Pilot ALT control panel - Set as follows:

(1) MODE switch - OFF.

(2) Press to test lamps - Check.

(3) CODE switch - Set to desired code.

NOTE

If RU FAULT or EU FAULT lamps light in TEST mode, rotate MODE switch to STBY and back to TEST. If either lamp lights again, refer to higher category of maintenance. The TRACK lamp may light a few times in the TEST mode.

(4) MODE switch - TEST.

NOTE

It will take about 25 seconds until GO lamp and TRACK lamp light. The GO lamp goes off after about 30 seconds.

4-14. BEFORE TAKEOFF CHECK —ALL ARMAMENT.

1. Gunner PLT ORIDE switch — OFF.
2. Pilot MASTER ARM switch — STBY.
3. TCP — TSU/GUN.
4. TOW launchers — Missile arming lever down.
5. Wing ejector rack jettison safety pins — Removed.

4-15. INFLIGHT PROCEDURES — ALL ARMAMENT.

The following armament inflight procedure paragraphs are based on only one weapon installed, all armament circuit breakers in, and armament preflight interior check performed. Refer to figure 4-3 for firing modes when two or more weapons are installed.

4-16. TURRET OPERATION — INFLIGHT PROCEDURES.

CAUTION

The M-197 gun is restricted to a firing schedule not to exceed a 450-round burst with a minimum of 6 minutes cooling time prior to firing the remaining 300 rounds.

NOTE

The possibility of interruptive fire exists at any time the gun is fired at a near 0 degree azimuth with the helicopter in an extreme nose low attitude. This is due to the gun reaching the upper limit.

1. Turret Firing (TSU) is accomplished as follows:
   a. Pilot MASTER ARM switch — ARM.
   b. Pilot WPN CONTR switch — GUNNER.
   c. Pilot RECOIL switch — COMPEN.
   d. Pilot RECOIL COMP switch — As desired.
   e. Gunner PLT ORIDE switch — OFF.
   f. Gunner RANGE switch — As desired.
   g. Gunner TSU/GUN SLEW RATE — As desired.
   h. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.
   i. Gunner TUR SLEW switch — NORM.
   j. Gunner — LASER RANGE MIN RANGE DISPLAY switch — DISPLAY.
   k. Gunner LASER RANGE MIN RANGE SET switch — Select desired minimum range (setting displayed in TSU).
   l. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.
   m. TSU filter lever — Set to L.
   n. TCP LASER ARM switch — 1ST or LAST, as desired.
   o. Gunner TCP MODE SELECT switch — TSU/GUN.
   p. Gunner SHC/ACQ/TRK/STOW switch — TRK.
   q. Gunner LHG HI LO MAG switch — As desired.
   r. LHG ACTION switch — Press.
   s. TSU reticle — On target.
   t. LHG LASER switch — Press. Switch must be positively held in position to obtain range data.
   u. LHG TRIGGER — Press.
   v. LHG TRIGGER — Release.
   w. LHG ACTION switch — Release.
   x. LHG LASER switch — Release.
   y. TCP MODE SELECT switch — OFF.
   z. Gunner TCP LASER ARM — OFF.
   aa. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.
   ab. Pilot MASTER ARM switch — OFF.
   ac. Emergency procedures — Refer to paragraph 9-53.

2. Turret firing (GHS) (normal selection) is accomplished as follows:

   TCP MODE SELECT switch must be in OFF position, or with MODE SELECT switch in TSU/GUN position the SHC/ACQ/TRK/STOW switch must be in STOW position to fire the turret with GHS.

   a. Pilot MASTER ARM switch — ARM.
   b. Pilot WPN CONTR switch — GUNNER.
   c. Pilot RECOIL switch — COMPEN.
   d. Pilot RECOIL COMP switch — As desired.
   e. Gunner PLT ORIDE switch — OFF.
   f. Gunner HSS RTCL knob — As desired.
   g. Gunner RANGE switch — As desired.
   h. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.
   i. Gunner TUR SLEW switch — NORM.
   j. LHG ACTION switch — Press.

k. GHS reticle — On target.

l. LHG TRIGGER switch — Press.

m. LHG TRIGGER switch — Release.

n. LHG ACTION switch — Release.

o. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.

p. Pilot MASTER ARM switch — OFF.

q. Emergency procedures — Refer to paragraph 9-53.

3. Turret firing (GHS) (pilot override selection) is accomplished as follows:

a. Gunner PLT ORIDE switch — PLT ORIDE.

b. Gunner HSS RTCL knob — As desired.

c. Gunner RANGE switch — As desired.

d. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

e. Gunner TUR SLEW switch — NORM.

f. Gunner cyclic TRIGGER ACTION switch — Press.

g. GHS reticle — On target.

h. Gunner cyclic TRIGGER TURRET FIRE switch — Press.

i. Gunner cyclic TRIGGER TURRET FIRE switch — Release.

j. Gunner cyclic TRIGGER ACTION switch — Release.

k. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.

l. Gunner PLT ORIDE switch — OFF.

m. Emergency procedures — Refer to paragraph 9-53.

4. Turret firing (PHS) (method #1) is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot HSS RTCL knob — As desired.

c. Pilot RANGE switch — As desired.

d. Pilot WPN CONTR switch — PILOT.

e. Pilot RECOIL switch — COMPEN.

f. Pilot RECOIL COMP switch — As desired.

g. Gunner PLT ORIDE switch — OFF.

h. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

i. Gunner TUR SLEW switch — NORM.

j. Pilot cyclic TRIGGER ACTION switch — Press.

k. PHS reticle — On target.

l. Pilot cyclic TRIGGER TURRET FIRE switch — Press.

m. Pilot cyclic TRIGGER TURRET FIRE switch — Release.

n. Pilot cyclic TRIGGER ACTION switch — Release.

o. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.

p. Pilot MASTER ARM switch — OFF.

q. Emergency procedures — Refer to paragraph 9-53.

5. Turret firing (PHS) (method #2) is accomplished as follows:

NOTE

This method allows the pilot to fire the turret using his helmet sight while the gunner is targeting with the TSU. Switch positions are the same except the following:

a. Pilot WPN CONTR switch — GUNNER.

b. TCP MODE SELECT — STBY TOW, ARMED MAN or AUTO.

6. Turret firing (fixed forward) is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONTR switch — FIXED.

c. HUD PWR switch — ON.

d. HUD MODE switch — NORM.

e. HUD AUTO BRT switch — As desired.

f. Pilot cyclic TRIGGER ACTION switch — Press.

g. HUD fire control reticle — On target.

h. Pilot cyclic TRIGGER TURRET FIRE switch — Press. The FCC provides no ballistic compensation for the FIXED MODE. The GUN is aligned to the Boresight reference symbol in the HUD.

i. Pilot cyclic TRIGGER TURRET FIRE switch — Release.

j. Pilot cyclic TRIGGER ACTION switch — Release.

k. HUD PWR switch — OFF.

l. Pilot WPN CONTR switch — PILOT.

m. Pilot MASTER ARM switch — OFF.

n. Emergency procedures — Refer to paragraph 9-53.

4-17. TOW OPERATION — INFLIGHT PROCEDURES.

1. TOW firing is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONTR switch — GUNNER.

c. HUD PWR switch — ON.

d. HUD MODE switch — NORM.

e. HUD AUTO BRT switch — As desired.

f. Gunner TCP MODE SELECT switch — ARMED MAN for manual missile selection, ARMED AUTO for automatic missile selection. TCP system status annunciator displays ARMED.

g. Gunner TCP LASER ARM switch — 1ST or LAST, as desired.

h. TSU filter lever — Set to L.

i. Gunner TSU LHG MAG switch — LO. Switch must be positively held in position before releasing.

j. Gunner TSU reticle — Focus.

k. Gunner TSU RTCL knob — As desired.

l. Gunner TCP MISSILE SELECT switch — Set to first loaded missile if TCP MISSILE SELECT switch is ARMED MAN.

m. Gunner — LASER RANGE MIN RANGE DISPLAY switch — DISPLAY.

n. Gunner — LASER RANGE MIN RANGE SET switch — Select desired minimum range (setting displayed in TSU).

o. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.

p. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

q. Gunner HS reticle — On target.

r. Gunner SHC ACQ/TRK/STOW switch — ACQ.

s. Gunner SHC ACQ/TRK/STOW switch — Release to TRK.

t. Gunner TSU reticle — On target.

u. Gunner TSU LHG MAG switch — HI. Switch must be positively held in position before releasing.

v. Gunner SHC track control stick — Move as required to keep TSU crosshairs on target.

w. Gunner LHG LASER switch — Press. Switch must be positively held in position to obtain range data.

x. Helicopter position — Maneuver to keep flashing gunner LOS symbol in HUD field of view.

y. Gunner TSU LHG ACTION switch — Press and hold. Gunner TSU reticle A battle flag comes on, HUD displays prelaunch constraint and missile symbol. LOS symbol flashing if outside of constraint and ascend/descend pointer appears when maneuver required. Keeping the TSU LHG ACTION switch pressed provides motion compensation by the TSU for a target during tracking.

z. Helicopter position — Maneuvered to align gunner LOS symbol within prelaunch window of HUD and maintain a roll attitude of less than ±5°. Gunners LOS symbol ceases flashing and TSU gunner reticle R battle flag comes on.

aa. Gunner TSU LHG TRIGGER switch — Pressed when helicopter is within range of target. Pilot HUD X symbol appears over missile symbol. After 1.5 seconds missile symbol and prelaunch constraint disappear and gunner TSU A and R battle flags go out. Gunner cannot fire if the helicopter is not within the prelaunch constraint boundary. Gunner can override the prelaunch constraint boundary limitation by pressing the CONST OVRD switch on the SHC; however degraded accuracy should be expected. Smoke may emerge from launcher after TRIGGER is pressed and before missile exits launcher. The smoke is caused by the missile gyro and battery squibs firing and should not be regarded as a misfire. A misfire has occurred if missile fails to exit launcher within 1.5 seconds. After missile firing, release TSU LHG TRIGGER switch. Do not press the LHG TRIGGER during wire cutting because another missile will be launched if the TCP MODE SELECT switch is in the ARMED AUTO position and the helicopter is within prelaunch constraints.

WARNING

Do not turn helicopter to the side from which a missile is fired. The helicopter may strike the command wire.

ab. Gunner LHG TRIGGER switch — Release.

ac. Gunner LHG ACTION switch — Release.

ad. Helicopter position — Manuevered to keep gunner LOS symbol within postlaunch constraint of HUD until wire cut or missile impact. Postlaunch constraint disappears on wire cut or missile impact.

CAUTION

Loss of missile guidance could result if a maneuver exceeding postlaunch constraint boundary is made.

Firing TOW missiles over high voltage lines may result in damage to TOW system.

ae. Gunner TSU reticle crosshairs — On target until wire cut or missile impact. Gunner SHC track control stick used to keep crosshairs on target.

af. WIRE CUT button — Press.

ag. Additional missile firing — The next missile is selected automatically if the gunner TCP MODE SELECT switch is on ARMED AUTO, manually selected by the MISSILE SELECT switch if switch is on ARMED MAN.

(1) HUD — Displays missile selected when LHG ACTION switch is pressed.

(2) Gunner TSU LHG MAG switch — LO. Switch must be positively held in position before releasing.

(3) Fire missile — Repeat steps n. through ag.

ah. Gunner TCP MODE SELECT switch — OFF.

ai. Gunner TCP LASER ARM switch — OFF.

aj. HUD PWR switch — OFF.

ak. Pilot WPN CONTR switch — PILOT.

al. Pilot MASTER ARM switch — OFF.

am. Emergency procedures — Refer to paragraph 9-52.

4-18. ROCKET OPERATION — INFLIGHT PROCEDURES.

1. Rocket direct with laser ranging is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WING STORE switch — RKT.

c. RMS QTY selector — As desired.

d. RMS ZONE ARM switches — As desired.

e. RMS MODE selector — As desired.

f. RMS RATE selector — As desired.

g. RMS RNG-km selector — A.

h. RMS PEN-M selector — As desired.

i. HUD PWR switch — ON.

j. HUD MODE select switch — NORM.

k. HUD RKT switch — DIR.

l. HUD AUTO BRT switch — As desired.

m. TSU filter lever — Set to L.

n. TCP MODE SELECT switch — Not OFF.

o. Gunner TCP LASER ARM switch — 1ST or LAST, as desired.

p. Gunner — LASER RANGE MIN RANGE DISPLAY switch — DISPLAY.

q. Gunner — LASER RANGE MIN RANGE SET switch — Select desired minimum range (setting displayed in TSU).

r. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.

s. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

t. Gunner HS reticle — On target.

u. Gunner SHC ACQ/TRK/STOW switch — ACQ.

v. Gunner SHC ACQ/TRK/STOW switch — TRK.

w. Gunner LHG HI LOW MAG switch — As desired.

x. Gunner TSU reticle — On target.

y. Gunner TSU RTCL BRT knob — Adjust.

z. LHG LASER switch — Press. Switch must be positively held in position to obtain range data.

aa. Helicopter position — Maneuver to put HUD fire control reticle on target. The HUD fire control reticle will continue to get accurate rocket solution, based on movement of the helicopter, for fifteen seconds after gunner has stopped firing the laser range finder.

ab. Pilot cyclic WING ARM FIRE switch — Press.

ac. Pilot cyclic WING ARM FIRE switch — Release.

ad. HUD PWR switch — OFF.

ae. RMS ZONE ARM switches — OFF, deselected.

af. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.

ag. Gunner TCP LASER ARM switch — OFF.

ah. Pilot MASTER ARM switch — OFF.

2. Rocket direct with estimated range is accomplished as follows:

   a. Pilot MASTER ARM switch — ARM.

   b. Pilot WING STORE switch — RKT.

   c. RMS QTY selector — As desired.

   d. RMS ZONE ARM switches — As desired.

   e. RMS MODE selector — As desired.

   f. RMS RATE selector — As desired.

   g. RMS RNG-km selector — Select estimated range.

   h. RMS PEN-M selector — As desired.

   i. HUD PWR switch — ON.

   j. HUD MODE select switch — NORM.

   k. HUD RKT switch — DIR.

   l. HUD AUTO BRT switch — As desired.

   m. Helicopter position — Maneuver to put HUD fire control reticle on target. The Fire Control System will provide a fire control ballistic solution for rockets in the HUD based on the F range displayed in the HUD. This range will change based on the movement of the aircraft for 15 seconds after the RMS RNG-km switch is moved to a new range. After 15 seconds the steady solution presented in the HUD and the F range in the HUD will be the same as the RMS range selected. If FCC power is lost for a period beyond one second, turn the MASTER ARM switch OFF and back ON to restore the data communication between the two systems. This communication can be checked by determining if the range selected on the RMS is displayed in the HUD with the FCC on.

   n. Pilot cyclic WING ARM FIRE switch — Press.

   o. Pilot cyclic WING ARM FIRE switch — Release.

   p. HUD PWR switch — OFF.

   q. RMS ZONE ARM switches — Off, deselected.

   r. Pilot MASTER ARM switch — OFF.

3. Rocket indirect with laser ranging is accomplished as follows:

   a. Pilot MASTER ARM switch — ARM.

   b. Pilot WING STORE switch — RKT.

   c. RMS QTY selector — As desired.

   d. RMS ZONE ARM switches — As desired.

   e. RMS MODE selector — As desired.

   f. RMS RATE selector — As desired.

   g. RMS RNG-km selector — A.

   h. RMS PEN-M selector — As desired.

   i. HUD PWR switch — ON.

   j. HUD MODE select switch — NORM.

   k. HUD RKT switch — IND.

   l. HUD AUTO BRT switch — As desired.

   m. TSU filter lever — Set to L.

   n. TCP MODE SELECT switch — Not OFF.

   o. Gunner TCP LASER ARM switch — 1ST or LAST, as desired.

   p. Gunner — LASER RANGE MIN RANGE DISPLAY switch — DISPLAY.

   q. Gunner — LASER RANGE MIN RANGE SET switch — Select desired minimum range (setting displayed in TSU).

   r. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.

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s. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

t. Gunner HS reticle — On target.

u. Gunner SHC ACQ/TRK/STOW switch — ACQ.

v. Gunner SHC ACQ/TRK/STOW switch — TRK.

w. Gunner LHG HI LO MAG switch — As desired.

x. Gunner TSU reticle — On target.

y. Gunner TSU RTCL BRT knob — Adjust.

z. LHG LASER switch — Press. Switch must be positively held in position to obtain range data.

aa. Helicopter position — Maneuver to superimpose fire control reticle over boresight reference symbol. The HUD fire control reticle will continue to get an accurate rocket solution based on movement of the aircraft for 15 seconds after the gunner ceases to FIRE the LASER RANGE FINDER.

ab. Pilot cyclic WING ARM FIRE switch — Press.

ac. Pilot cyclic WING ARM FIRE switch — Release.

ad. HUD PWR switch — OFF.

ae. RMS ZONE ARM switches — Off, deselected.

af. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.

ag. Gunner TCP LASER ARM switch —OFF.

ah. Pilot MASTER ARM switch — OFF.

4. Rocket indirect with estimated ranging is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WING STORE switch — RKT.

c. RMS QTY selector — As desired.

d. RMS ZONE ARM switches — As desired.

e. RMS MODE selector — As desired.

f. RMS RATE selector — As desired.

g. RMS RNG-km selector — Select estimated range.

h. RMS PEN-M selector — As desired.

i. HUD PWR switch — ON.

j. HUD MODE select switch — NORM.

k. HUD RKT switch — IND.

l. HUD AUTO BRT switch — As desired.

m. Gunner TCP MODE SELECT switch — Not OFF.

n. TSU reticle — On target.

o. Helicopter position — Maneuver to superimpose HUD fire control reticle over boresight reference symbol. The Fire Control System will provide a fire control ballistic solution for rockets in the HUD based on the F range displayed in the HUD. This range will change based on the movement of the aircraft for 15 seconds after the RMS RNG-km switch is moved to a new range. After 15 seconds the steady solution presented in the HUD and the F range in the HUD will be the same as the RMS Range selected. If FCC power is lost for a period beyond one second, turn the MASTER ARM switch OFF and back ON to restore the data communication between the two systems. This communication can be checked by determining if the range selected on the RMS is displayed in the HUD with the F FCC on.

p. Pilot cyclic WING ARM FIRE switch — Press.

q. Pilot cyclic WING ARM FIRE switch — Release.

r. HUD PWR switch — OFF.

s. RMS ZONE ARM switches — Off, deselected.

t. Pilot MASTER ARM switch — OFF.

5. Rocket firing without FCC. This method provides a means to fire rockets when the FCC has failed. LASER RANGE FINDER must be firing at target for this method to be valid. An L indicates that raw laser range is being displayed. An LA superimposed on the fire control reticle also alerts the pilot that the FCC has failed and that raw laser range is being displayed. The fire control for rockets, when the FCC is turned off, is provided by the use of a range adjusted ballistic solution in the HUD if a laser range is provided. This range solution is based on a velocity of 120 KIAS forward airspeed. If a laser range is not present, (the laser range finder actually firing at the target) the HUD system will give an erroneous range and solution in the HUD. This will sometimes appear as double images in the HUD. Any double image or erroneous display in the HUD can be removed by cycling the HUD OFF, then ON. The RMS range has no effect in the HUD with the FCC turned OFF. If the FCC is turned OFF or fails with the laser rangefinder not installed or not operational, the HUD unit should be switched to STAD.

Firing is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WING STORE switch — RKT.

c. TSU filter lever — Set to L.

d. TCP MODE SELECT switch — Not OFF.

e. Gunner TCP LASER ARM switch — 1ST or LAST — As desired.

f. Gunner — LASER RANGE MIN RANGE DISPLAY switch — DISPLAY.

g. Gunner — LASER RANGE MIN RANGE SET switch — Select desired minimum range (setting displayed in TSU).

h. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.

i. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

j. Gunner HS reticle — On target.

k. Gunner SHC ACQ/TRK/STOW switch — ACQ.

l. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.

m. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.

n. Gunner HS reticle — On target.

o. Gunner SHC ACQ/TRK/STOW switch — ACQ.

p. Gunner SHC ACQ/TRK/STOW switch — TRK.

q. Gunner LHG HI LO MAG switch — As desired.

r. Gunner TSU reticle — On target.

s. Gunner TSU RTCL BRT knob — As desired.

t. Gunner LHG LASER switch — Press. Switch must be positively held in position to obtain range data.

u. RMS QTY selector — As desired.

v. RMS ZONE ARM switches — As desired.

w. RMS MODE selector — As desired.

x. RMS RATE selector — As desired.

y. RMS RNG-KM selector — Set in range displayed on HUD.

z. RMS PEN-M selector — As desired.

aa. Helicopter position — Maneuver to put HUD fire control reticle on target.

ab. Pilot cyclic WING ARM FIRE switch — Press.

ac. Pilot cyclic WING ARM FIRE switch — Release.

ad. HUD PWR switch — OFF.

ae. RMS ZONE ARM switches — Off, deselected.

af. LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.

ag. Gunner TCP LASER ARM switch — OFF.

ah. TCP MODE SELECT switch — OFF.

ai. Pilot MASTER ARM switch — OFF.

6. Rocket firing without FCC and LRF is accomplished as follows:

NOTE

Stadiametric reticle must be used when firing in this method.

a. Pilot MASTER ARM switch — ARM.

b. Pilot WING STORE switch — RKT.

c. RMS QTY selector — As desired.

d. RMS ZONE ARM switches — As desired.

e. RMS MODE selector — As desired.

f. RMS RATE selector — As desired.

g. RMS RNG-KM selector — Set in estimated range.

h. RMS PEN-M selector — As desired.

i. HUD PWR switch — ON.

j. HUD MODE select switch — STAD.

k. HUD AUTO BRT switch — As desired.

l. Helicopter position — Maneuver to put stadiametric reticle on target.

m. Pilot WING ARM FIRE switch — Press.

n. Pilot WING ARM FIRE switch — Release.

o. HUD PWR switch — OFF.

p. RMS ZONE ARM switches — Off, deselected.

q. Pilot MASTER ARM switch — OFF.

4-19. WING GUN POD OPERATION — INFLIGHT PROCEDURE.

Wing gun pod firing is accomplished as follows:

1. Pilot MASTER ARM switch — ARM.

WARNING

If rockets are being fired, the pilot cyclic WING ARM FIRE switch must be released prior to moving WING STORE switch from RKT to GUN. Wing gun pod rounds may detonate inflight rockets in proximity of helicopter.

2. Pilot WING STORE switch — GUN.
3. HUD PWR switch — ON.
4. HUD MODE select switch — STAD.
5. TSU filter lever — Set to L.
6. TCP MODE SELECT switch — Not OFF.
7. Gunner TCP LASER ARM switch — 1ST or LAST, as desired.
8. Gunner LASER SAFE/TURRET DEPR LIMIT switch — OFF.
9. Gunner HS reticle — On target.
10. Gunner SHC ACQ/TRK/STOW switch — ACQ.
11. Gunner SHC ACQ/TRK/STOW switch — TRK.
12. Gunner TSU reticle — On target.
13. Gunner — LASER RANGE MIN RANGE DISPLAY switch — DISPLAY.
14. Gunner — LASER RANGE MIN RANGE SET switch — Select desired minimum range (setting displayed in TSU).
15. Gunner — LASER RANGE MIN RANGE DISPLAY switch — OFF.
16. Gunner LHG LASER switch — Press. Switch must be positively held in position to obtain range data.
17. Helicopter position — Maneuver to put stadiametric reticle on target.
18. Pilot WING ARM FIRE switch — Press.
19. Pilot WING ARM FIRE switch — Release.
20. HUD PWR switch — OFF.
21. Gunner TCP LASER ARM switch — OFF.
22. TCP MODE SELECT switch — OFF.
23. Gunner LASER SAFE/TURRET DEPR LIMIT switch — LASER SAFE/TURRET DEPR LIMIT.
24. Pilot MASTER ARM switch — OFF.

4-20. WING STORES JETTISON — INFLIGHT PROCEDURES.

Refer to Chapter 9, Section II.

4-20.1. ALT — INFLIGHT PROCEDURES.

1. Pilot INV circuit breaker — IN.
2. Pilot BATTERY switch — RUN.
3. Pilot ALT POWER (10 ampere) circuit breaker — IN.
4. Pilot ALT POWER (1 ampere) circuit breaker — IN.
5. Pilot WPN CONTR circuit breaker switch — ON.
6. Pilot ARMT CONTR circuit breaker switch — ON.
7. Pilot MASTER ARM switch — STANDBY.
8. Pilot ALT control panel — Set as follows:
   (1) CODE thumbwheel switches — Set to assigned code.

NOTE

Prior to moving MODE switch to SCAN 1 or SCAN 2, allow 20 seconds for ALT gyros to warm up.

(2) MODE switch — SCAN 1 for scanning 0 to -8.3 degrees elevation and ± 15 degrees azimuth or SCAN 2 for scanning 0 to -25 degrees elevation and ± 60 degrees azimuth.

NOTE

When the ALT locks onto your target, the TRACK lamp will light. To maintain lock on, keep the target forward (azimuth: 180°, elevation: 30° up and 60° down) of your aircraft. If TRACK lamp goes off, the ALT has lost lock on. In this case, the ALT will automatically resume the scanning mode selected on the MODE switch.

9. Manuever aircraft — Direction of target.

10. TRACK lamp — Verify on.

NOTE

If the ALT lock on is lost in Step (1), the TSU will move full right and down, and it may be necessary to recycle to the STOW position with the ACQ TRACK STOW switch before another acquisition can be initiated.

11. Gunner ACQ switch — ALT position to aim TSU to ALT line of sight.

4-21. BEFORE LANDING CHECK — ALL ARMAMENT.

1. Gunner PLT ORIDE switch — OFF.
2. Pilot MASTER ARM switch — STBY.
3. TCP - TSU/GUNS.
4. Turret drive motor circuit breaker - Out.
5. GUN ELEV STOW light - Check ON.

4-22. BEFORE LEAVING HELICOPTER CHECK — ARMAMENT.

WARNING

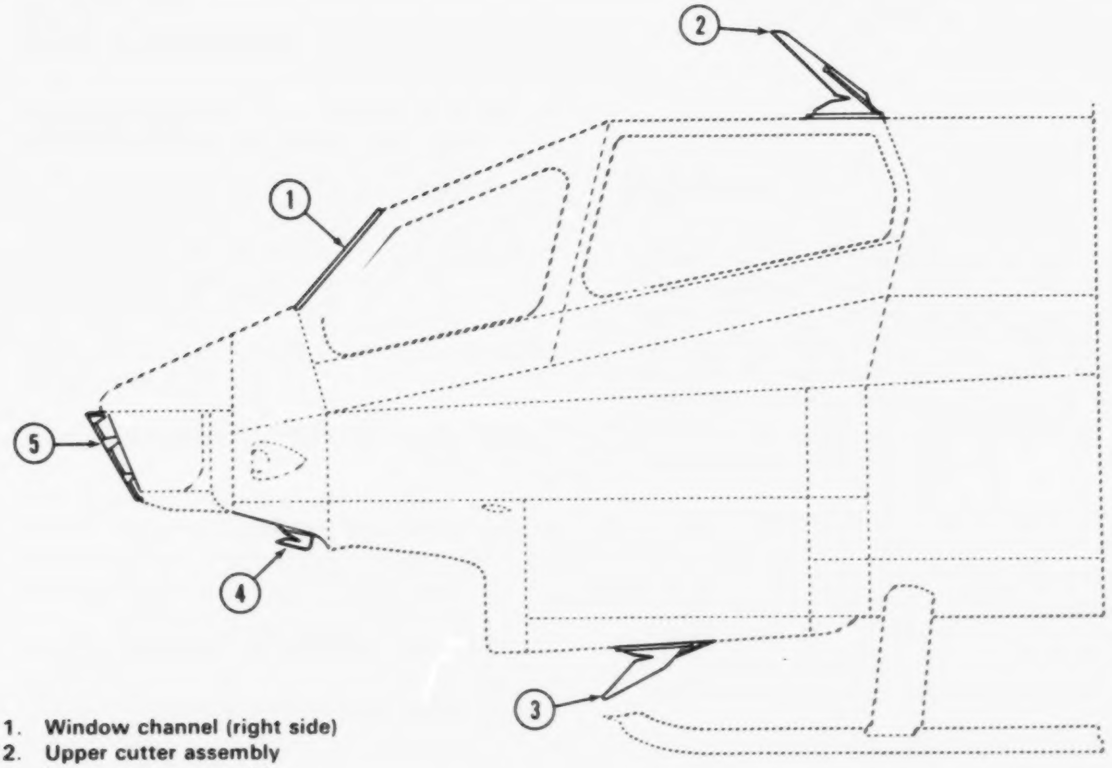
Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from EMI (electromagnetic interference).

1. HUD NIGHT FILTER — Retracted.
2. Wing ejector rack jettison safety pins — Installed.
3. TOW missile arming lever — UP.
4. Rocket igniter arms — In contact with rockets. Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from electromagnetic interference (EMI).

SECTION III. PASSIVE DEFENSE

4-23. WIRE STRIKE PROTECTION SYSTEM.

The wire strike protection system (figure 4-21) consists of three cutter assemblies, a windshield channel and a nose deflector. An upper cutter assembly is mounted on top of the pilot station, forward of the ADF loop antenna. A chin cutter assembly is mounted under the nose, just forward of the gunner station. A lower cutter assembly is mounted on the forward fuselage, under the ammunition compartment. The wire strike protection system is designed to protect the helicopter from wire obstructions at low levels of flight.



1. Window channel (right side)
2. Upper cutter assembly
3. Lower cutter assembly
4. Chin cutter assembly
5. Nose deflector

209704-25

Figure 4-21. Wire Strike Protection System

CHAPTER 4.1 P

MISSION EQUIPMENT

NOTE

Paragraphs 4-1 through 4-23 provide information for the AH-1F (Modernized) helicopters. Paragraphs 4.1-1 through 4.1-22 provide information for the AH-1P (Production) helicopters. Paragraphs 4.2.1 through 4.2-22 provide information for the AH-1E (ECAS) helicopters.

SECTION I. MISSION AVIONICS

4.1-1. GUN CAMERA.

Complete provisions are provided for the installation of a gun camera in the telescopic sight unit.

SECTION II. ARMAMENT

4.1-2. AUTHORIZED ARMAMENT CONFIGURATIONS.

Figure 4.1-1 shows the authorized armament loading configurations.

4.1-3. INTERRELATION OF ARMAMENT.

The armament subsystems are interfaced with one another. Figure 4.1-2 shows the pilot and gunner control components in relationship to each armament subsystem.

4.1-4. ARMAMENT FIRING MODES.

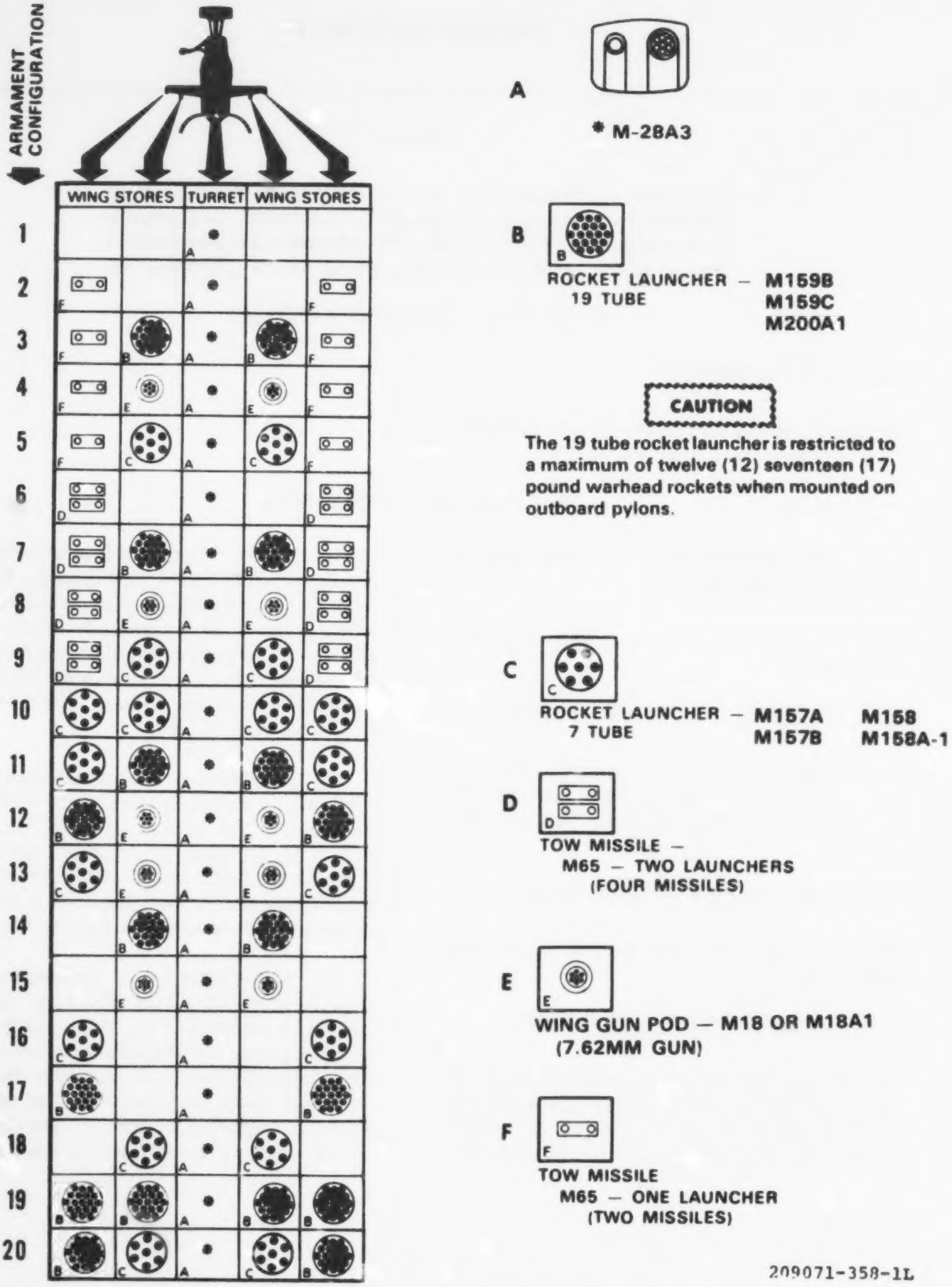
Figure 4.1-3 shows the switch positions for principal firing modes.

4.1-5. ARMAMENT DESCRIPTION.

a. Turret. The M28A3 series turret (figure 4.1-4) (TM 9-1090-203-12 and TM 9-1090-203-34) contains a 7.62 mm machine gun and a 40 mm grenade launcher. The ammunition drums (figure 4.1-5) are located in the ammunition bay. The turret is hydraulically and electrically operated. It can be fired in the fixed or flexible mode by the pilot, flexible mode by the gunner. The turret can travel 107.5 degrees left or right in azimuth and 12 to 17.5 degrees up and 50 degrees down in elevation. When the wing stores are being fired, the turret is interrupted until three seconds after the wing store trigger has been released.

(1) Machine Gun. The gun is an electrical driven, automatic, air-cooled, six barrel, and six bolts weapon. The gun is capable of firing six-second bursts at 2000 to 4000 rounds per minute. The ammunition drum stores a maximum of 4000 rounds of linked ammunition in a folding fan arrangement. The drum is driven by the machine gun drive motor through the flexible shaft.

(2) Grenade Launcher. The launcher is an electrically driven, rapid-firing, air-cooled weapon. The launcher is capable of firing 10-seconds burst at 400 grenades per minute. The launcher is cam operated by the gun drive through the flexible shaft. The ammunition drum stores a maximum of 265 linked anti-personnel fragmentation grenades. The drum is electrically driven by a motor mounted on the drum.



ARMAMENT CONFIGURATION	WING STORES		TURRET	WING STORES	
1			A		
2	F		A		F
3	F	B	A	B	F
4	F	E	A	E	F
5	F	C	A	C	F
6	D		A		D
7	D	B	A	B	D
8	D	E	A	E	D
9	D	C	A	C	D
10	C	C	A	C	C
11	C	B	A	B	C
12	B	E	A	E	B
13	C	E	A	E	C
14		B	A	B	
15		E	A	E	
16	C		A		C
17	B		A		B
18		C	A	C	
19	B	B	A	B	B
20	B	C	A	C	B

A * M-28A3

B ROCKET LAUNCHER — 19 TUBE M159B M159C M200A1

CAUTION

The 19 tube rocket launcher is restricted to a maximum of twelve (12) seventeen (17) pound warhead rockets when mounted on outboard pylons.

C ROCKET LAUNCHER — 7 TUBE M157A M157B M158 M158A-1

D TOW MISSILE — M65 — TWO LAUNCHERS (FOUR MISSILES)

E WING GUN POD — M18 OR M18A1 (7.62MM GUN)

F TOW MISSILE M65 — ONE LAUNCHER (TWO MISSILES)

Figure 4.1-1. Authorized Armament Configuration

CONTROL COMPONENTS	TURRET	TOW MISSILE	WING STORES		TARGET ACQUIRE FOR TSU	WING STORES JETTISON
			ROCKETS	GUN POD		
Pilot Station						
Armament Control Panel	X	X	X	X	X	
Pilot Rocket Control Panel			X	X		
Misc Control Panel						X
Wing Stores Jettison Switch						X
Pilot Steering Indicator		X				
Gunners Accuracy Control Panel		Training				
Reflex Sight	X		X	X		
Helmet Sight	X				X	
Cyclic Switches	X		X	X		
Gunner Station						
Cyclic Switches	X		X	X		
Helmet Sight	X				X	
Telescopic Sight Unit	X	X				
Left Hand Grip	X	X				
Armament Control Panel	X		X	X		
Wing Stores Jettison Switch						X
Sight Hand Control	X	X			X	
TOW Control Panel	X	X			X	

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Figure 4.1-2. Control Components in Relationship to Armament Subsystem

ARMAMENT CONFIGURATION 1

PILOT SWITCHES			GUNNER SWITCHES					GUNNER	PILOT	CAN		USING	
MASTER ARM	WPN CONT	WG ST ARM	PLT OVRD	WING STORES SELECT	MODE SELECT	ACQ TRK STOW	PHS ACQ			FIRE	ACQ TGT FOR TSU	SIGHT	WPN TRIG ON
ARM	GNR		OFF		OFF			Gnr		Tur		HS	LHG
					TSU/GUN	STOW		Gnr		Tur		HS	LHG
						TRK		Gnr		Tur		TSU	LHG
						ACQ		Gnr			Acq	HS	
						TRK	Press		Plt		Acq	HS	
					STBY TOW				Plt	Tur		HS	Cyc
					ARMED				Plt	Tur		HS	Cyc
	PLT		OFF						Plt	Tur		HS	Cyc
	FIXED		OFF						Plt	Tur		Reflex	Cyc
			OVRD					Gnr		Tur		HS	Cyc

ARMAMENT CONFIGURATION 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

PILOT SWITCHES			GUNNER SWITCHES					GUNNER	PILOT	CAN		USING	
MASTER ARM	WPN CONT	WG ST ARM	PLT OVRD	WING STORES SELECT	MODE SELECT	ACQ TRK STOW	PHS ACQ			FIRE	ACQ TGT FOR TSU	SIGHT	WPN TRIG ON
ARM	GNR	INBD/ OUTBD	OFF		OFF			Gnr		Tur		HS	LHG
									Plt	Ws		Reflex	Cyc
					TSU/ GUN	STOW		Gnr		Tur		HS	LHG
									Plt	Ws		Reflex	Cyc
						TRK		Gnr		Tur		TSU	LHG
									Plt	Ws		Reflex	Cyc
						ACQ		Gnr			Acq	HS	
						TRK	Press		Plt		Acq	HS	
					STBY TOW OR ARMED				Plt	Tur		HS	Cyc
										Ws		Reflex	Cyc
	PLT	INBD/ OUTBD	OFF						Plt	Tur		HS	Cyc
										Ws		Reflex	Cyc
	FIXED	INBD/ OUTBD	OFF						Plt	Tur		Reflex	Cyc
										Ws		Reflex	Cyc
			OVRD	INBD/ OUTBD				Gnr		Tur		HS	Cyc
										Ws		None	Cyc

209071-358-2C

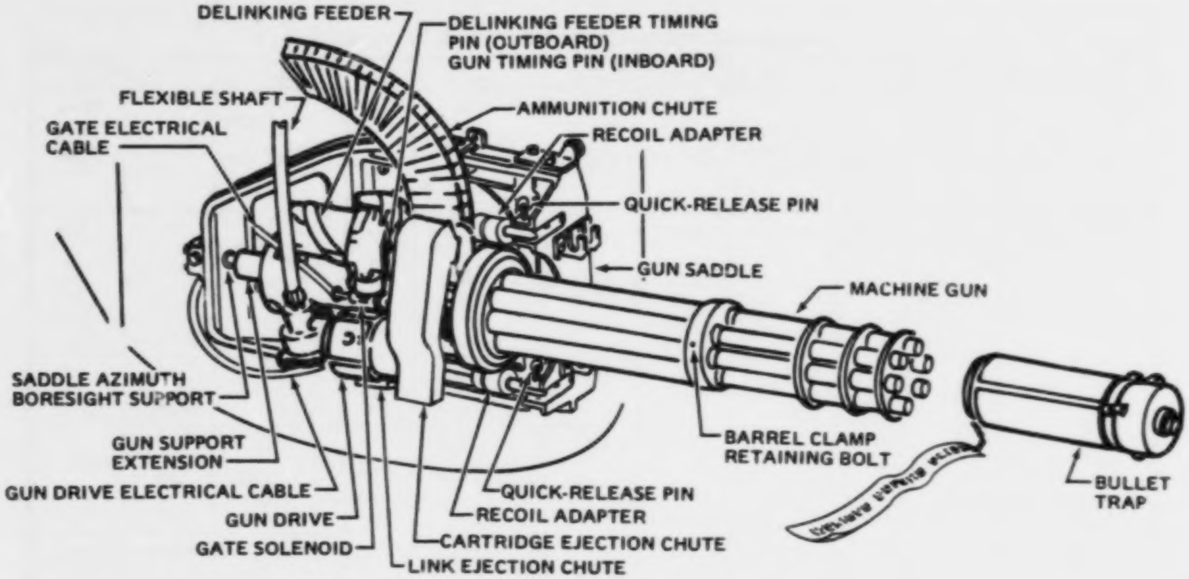
Figure 4.1-3. Armament Firing Modes (Sheet 1 of 2)

ARMAMENT CONFIGURATION 2, 3, 4, 5, 6, 7, 8, 9

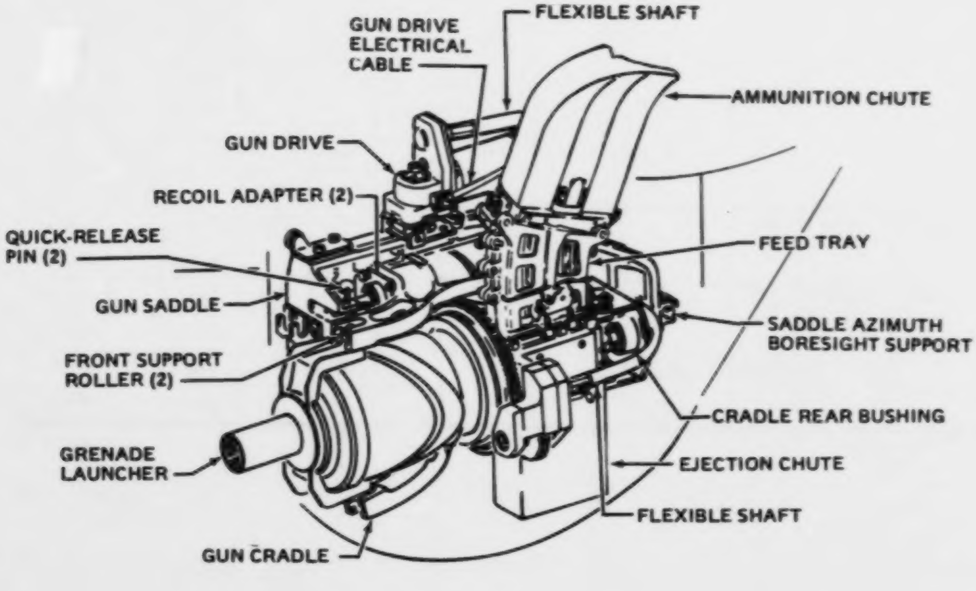
PILOT SWITCHES			GUNNER SWITCHES					GUNNER	PILOT	CAN		USING	
MASTER ARM	WPN CONT	WG ST ARM	PLT OVRD	WING STORES SELECT	MODE SELECT	ACQ TRK STOW	PHS ACQ			FIRE	ACQ TGT FOR TSU	SIGHT	WPN TRIG ON
ARM	GNR	INBD	OFF		OFF			Gnr		Tur		HS	LHG
									Plt	Inbd		Reflex	Cyc
					TSU/ GUN	STOW		Gnr		Tur		HS	LHG
									Plt	Inbd		Reflex	Cyc
						TRK		Gnr		Tur		TSU	LHG
									Plt	Inbd		Reflex	Cyc
						ACQ		Gnr			Acq	HS	
						TRK	Press		Plt		Acq	HS	
					STBY TOW	STOW			Plt	Tur		HS	Cyc
										Inbd		Reflex	Cyc
						TRK			Plt	Tur		HS	Cyc
										Inbd		Reflex	Cyc
						ACQ		Gnr			Acq	HS	
						TRK	Press		Plt		Acq	HS	
					ARMED	STOW			Plt	Tur		HS	Cyc
										Inbd		Reflex	Cyc
						TRK		Gnr		TOW		TSU	LHG
									Plt	Tur		HS	Cyc
										Inbd		Reflex	Cyc
						ACQ		Gnr			Acq	HS	
						TRK	Press		Plt		Acq	HS	
	PLT	INBD	OFF						Plt	Tur		HS	Cyc
										Inbd		Reflex	Cyc
	FIXED	INBD	OFF						Plt	Tur		Reflex	Cyc
										Inbd		Reflex	Cyc
			OVRD	INBD				Gnr		Tur		HS	Cyc
										Inbd		None	Cyc

209071-358-4A

Figure 4.1-3. Armament Firing Modes (Sheet 2 of 2)


DELINKING FEEDER
DELINKING FEEDER TIMING PIN (OUTBOARD)
GUN TIMING PIN (INBOARD)
FLEXIBLE SHAFT
GATE ELECTRICAL CABLE
AMMUNITION CHUTE
RECOIL ADAPTER
QUICK-RELEASE PIN
GUN SADDLE
MACHINE GUN
SADDLE AZIMUTH BORESIGHT SUPPORT
GUN SUPPORT EXTENSION
GUN DRIVE ELECTRICAL CABLE
GUN DRIVE
GATE SOLENOID
BARREL CLAMP RETAINING BOLT
QUICK-RELEASE PIN
RECOIL ADAPTER
CARTRIDGE EJECTION CHUTE
LINK EJECTION CHUTE
BULLET TRAP

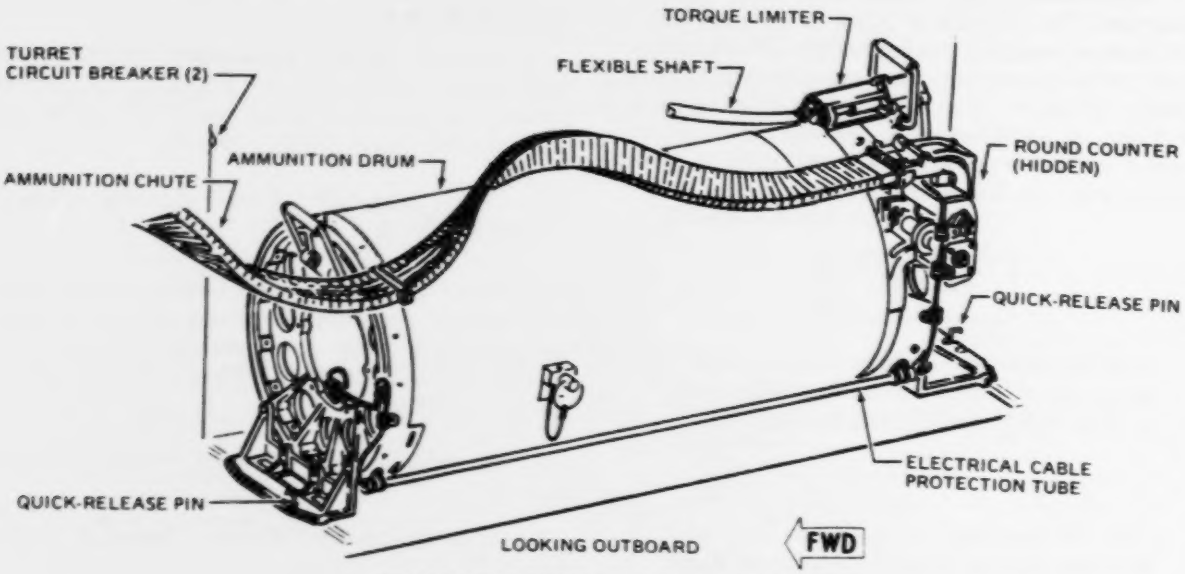
RIGHT SIDE OF TURRET -- MACHINE GUN


GUN DRIVE ELECTRICAL CABLE
FLEXIBLE SHAFT
AMMUNITION CHUTE
GUN DRIVE
RECOIL ADAPTER (2)
QUICK-RELEASE PIN (2)
FEED TRAY
GUN SADDLE
SADDLE AZIMUTH BORESIGHT SUPPORT
FRONT SUPPORT ROLLER (2)
CRADLE REAR BUSHING
GRENADE LAUNCHER
EJECTION CHUTE
FLEXIBLE SHAFT
GUN CRADLE

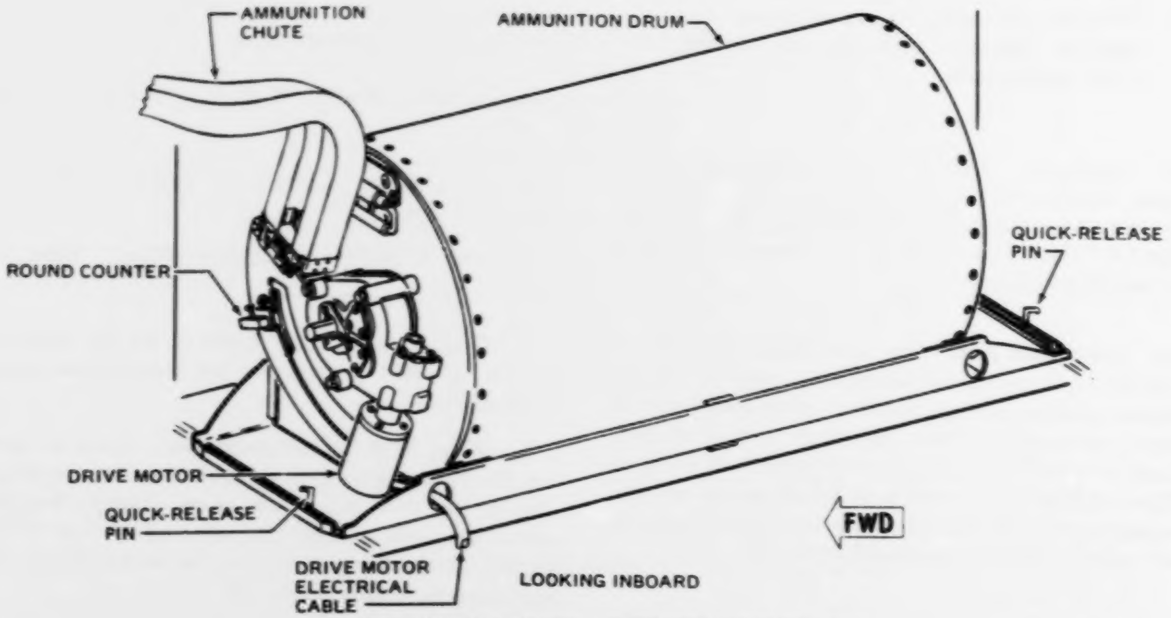
LEFT SIDE OF TURRET — GRENADE LAUNCHER

209071-342A

Figure 4.1-4. M28 Series Turret (Typical)


TORQUE LIMITER
TURRET CIRCUIT BREAKER (2)
FLEXIBLE SHAFT
AMMUNITION DRUM
AMMUNITION CHUTE
ROUND COUNTER (HIDDEN)
QUICK-RELEASE PIN
ELECTRICAL CABLE PROTECTION TUBE
QUICK-RELEASE PIN
LOOKING OUTBOARD
FWD

RIGHT AMMUNITION BAY — MACHINE GUN DRUM


AMMUNITION CHUTE
AMMUNITION DRUM
ROUND COUNTER
QUICK-RELEASE PIN
DRIVE MOTOR
QUICK-RELEASE PIN
FWD
DRIVE MOTOR ELECTRICAL CABLE
LOOKING INBOARD

LEFT AMMUNITION BAY — GRENADE LAUNCHER DRUM

209071-352A

Figure 4.1-5. Ammunition Drums

b. TOW Missile. The TOW (tube-launched, optically-tracked, wire command link) missile subsystem (TM 9-1425-473-20) is a heavy anti-tank/assault weapon. The subsystem utilizes optical and IR (infrared) means to track a target and guide the missile. Isolation from helicopter motions and vibrations is provided. One or two TML (TOW Missile Launcher) (figure 4.1-6) support two missiles each on the outboard ejector racks.

CAUTION

Use of night vision goggles with the TOW sight unit does not increase visibility and creates a risk of scratching the sight lens.

NOTE

The subsystem is designed to be effective during daylight conditions. Use at night may be effective if flares are used to augment visibility. Problems with glare on sight reticles, inability to adjust reticle in intensity during target tracking, and difficulty in acquiring targets at unknown locations during darkness, will degrade system performance during night operations.

c. Rockets. The 2.75 inch folding fin aerial rocket (FFAR) (TM 9-1055-460-14) subsystem is a light anti-personnel/assault weapon. A launcher (figure 4.1-7) can be mounted on each of the inboard and outboard ejector racks.

d. Wing Gun Pod. The pod (figure 4.1-8) (TM 9-1005-257-12) is self-contained unit housing a 7.62 mm machine gun, its own gun, its own electrical system, a battery recharging system, and a maximum of 1500 rounds of ammunition. The gun is capable of firing at 2000 or 4000 (M18A1) or 4000 (M18) rounds per minute. The pod configuration can be detected by the firing rate and heater switches on the rear of the pod.

e. Wing Stores Jettison (Figure 4.1-12). Each of the four ejector racks are equipped with an electrically operated ballistic device to jettison the attached weapon during an emergency. Each device has two cartridges. The second cartridge fires automatic if the first fails to fire. When four TOW missile launchers are installed on outboard wing stations the TOW missile launchers will jettison prior to the inboard store regardless of the jettison select switches position.

f. Helmet Sight Subsystem (HSS). The HSS (figure 4.1-9) (TM 9-1270-212-14) permits the pilot or gunner to direct the turret and/or the telescopic sight unit (TSU) to targets.

4.1-6. PILOT SWITCHES AND INDICATORS.

Pilot panels and switches are interfaced with other pilot/gunner panels and switches for weapon operations and wing stores jettison. Figure 4.1-2 shows panel interface. Figure 4.1-3 shows switch interface.

a. Armament Control Panel. Refer to figure 4.1-10.

b. Rocket Control Panel. Refer to figure 4.1-11.

c. Wing Stores Jettison Switch. The guarded jettison switch is on the pilot collective stick switchbox. Activation of the switch will jettison the weapons from the inboard, outboard, or all four of the wing ejector racks. Refer to figure 4.1-12 for various jettison combinations.

d. Jettison Select Switch. Refer to figure 4.1-12.

e. Armament Circuit Breakers. Refer to figure 4.1-13.

f. Pilot Steering Indicator (PSI). Refer to figure 4.1-14.

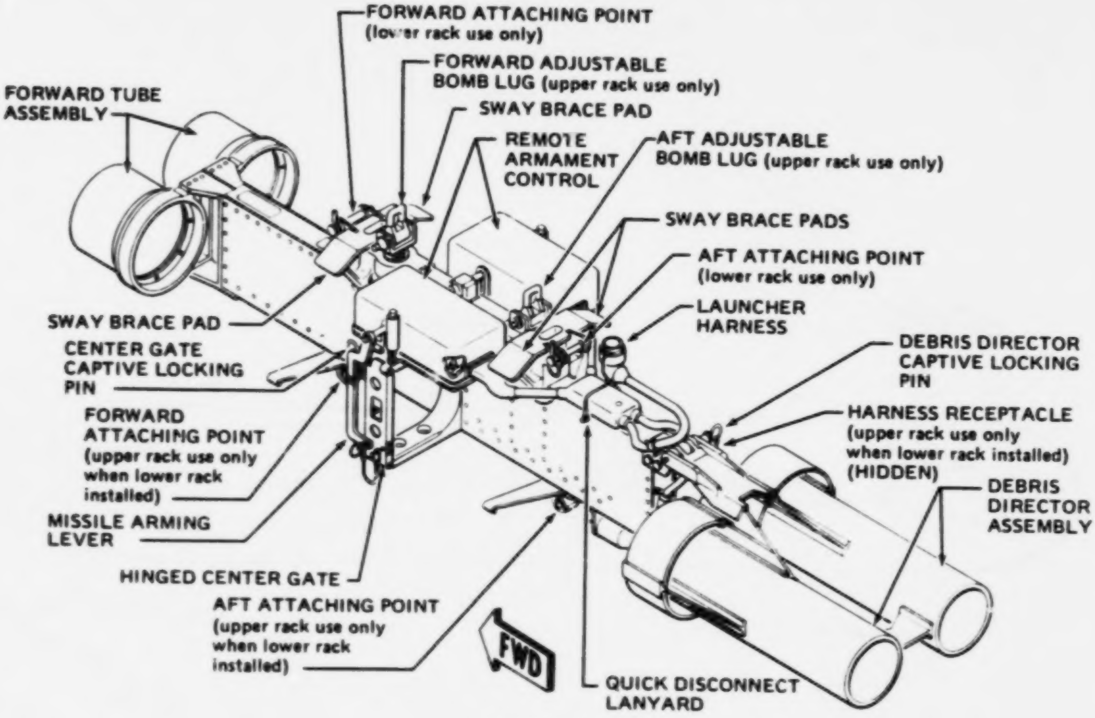
g. Gunner Accuracy Control Panel (GACP). (Figure 4.1-15.) Provisions are provided for panel installation.

h. Pilot TOW Status Indicator. Refer to figure 2-6. The TOW status indicator, located on the upper right side of the pilot instrument panel, informs the pilot which side the gunner has selected to fire a TOW missile, L (left), R (right) or gives the pilot a barber pole indicating no missile is selected.

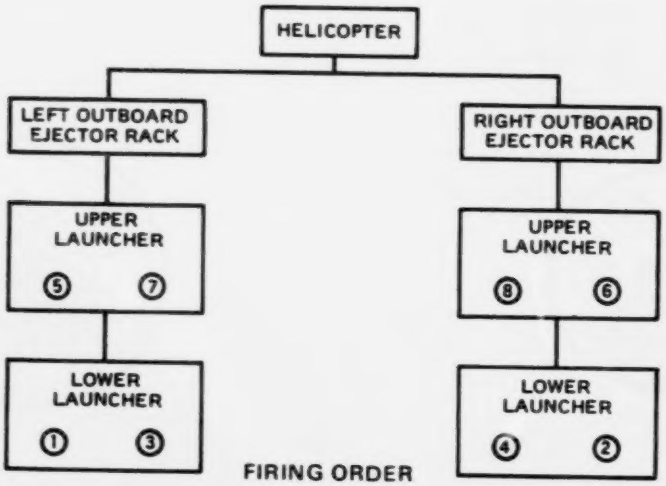
i. Reflex Sight. Refer to figure 4.1-16.

j. Pilot Helmet Sight. Refer to figure 4.1-9.

k. Cyclic Armament Switches. Refer to figure 2-13.


FORWARD ATTACHING POINT (lower rack use only)
FORWARD ADJUSTABLE BOMB LUG (upper rack use only)
FORWARD TUBE ASSEMBLY
SWAY BRACE PAD
REMOTE ARMAMENT CONTROL
AFT ADJUSTABLE BOMB LUG (upper rack use only)
SWAY BRACE PADS
AFT ATTACHING POINT (lower rack use only)
LAUNCHER HARNESS
SWAY BRACE PAD
CENTER GATE CAPTIVE LOCKING PIN
DEBRIS DIRECTOR CAPTIVE LOCKING PIN
FORWARD ATTACHING POINT (upper rack use only when lower rack installed)
HARNESS RECEPTACLE (upper rack use only when lower rack installed) (HIDDEN)
DEBRIS DIRECTOR ASSEMBLY
MISSILE ARMING LEVER
HINGED CENTER GATE
AFT ATTACHING POINT (upper rack use only when lower rack installed)
FWD
QUICK DISCONNECT LANYARD

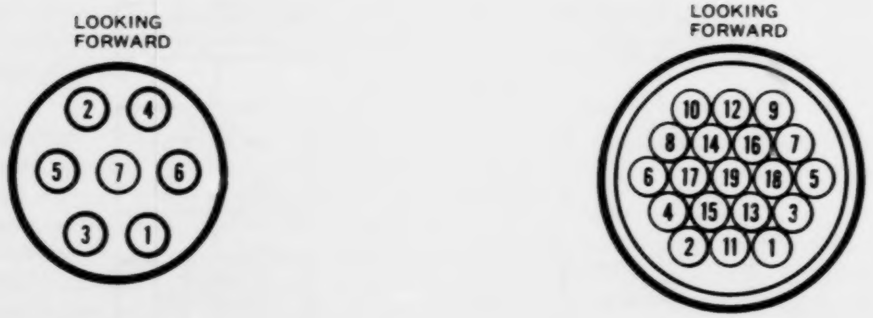
LAUNCHER


HELICOPTER
LEFT OUTBOARD EJECTOR RACK
RIGHT OUTBOARD EJECTOR RACK
UPPER LAUNCHER
⑤ ⑦
UPPER LAUNCHER
⑧ ⑥
LOWER LAUNCHER
① ③
LOWER LAUNCHER
④ ②

FIRING ORDER

209071-343A

Figure 4.1-6. TOW Missile Launcher


LOOKING FORWARD
2
4
5
7
6
3
1
LOOKING FORWARD
10
12
9
8
14
16
7
6
17
19
18
5
4
15
13
3
2
11
1

7 TUBE LAUNCHER FIRING ORDER

19 TUBE LAUNCHER FIRING ORDER

209071-355F

Figure 4.1-7. Folding Fin Aerial Rocket (2.75 Inch) Launcher

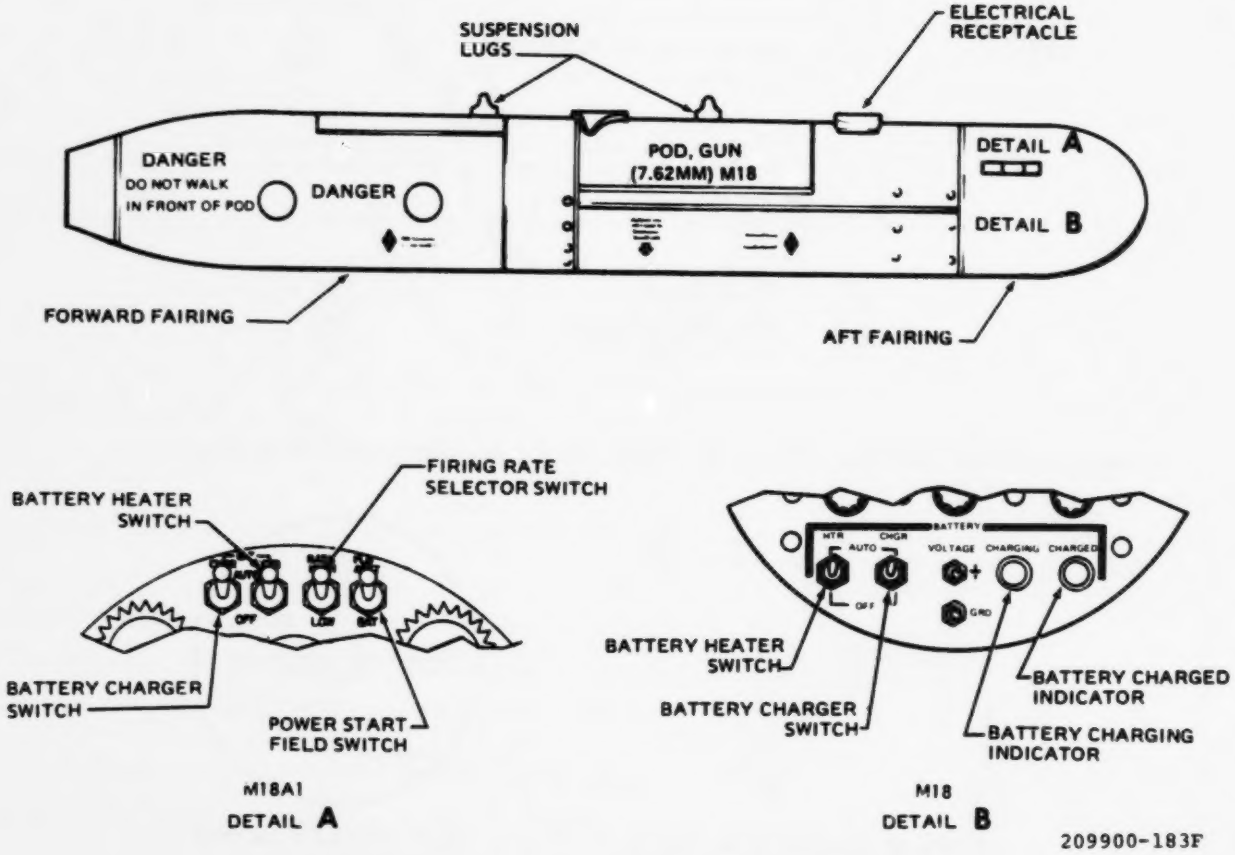
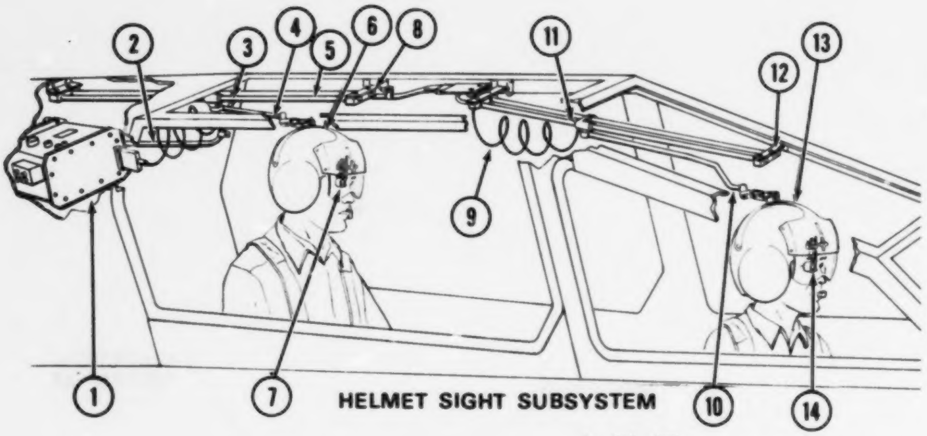
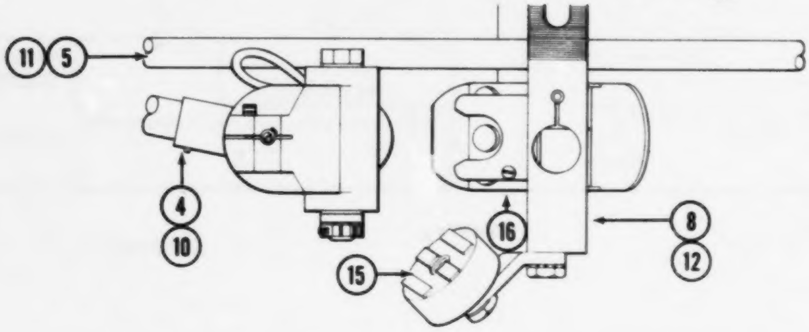

SUSPENSION LUGS
ELECTRICAL RECEPTACLE
DANGER
DO NOT WALK IN FRONT OF POD
DANGER
POD, GUN (7.62MM) M18
DETAIL A
DETAIL B
FORWARD FAIRING
AFT FAIRING
BATTERY HEATER SWITCH
FIRING RATE SELECTOR SWITCH
OFF
LOW
BAT
BATTERY CHARGER SWITCH
POWER START FIELD SWITCH
M18A1
DETAIL A
BATTERY
HTR
CHGR
AUTO
OFF
VOLTAGE
+
GRD
CHARGING
CHARGED
BATTERY HEATER SWITCH
BATTERY CHARGER SWITCH
BATTERY CHARGED INDICATOR
BATTERY CHARGING INDICATOR
M18
DETAIL B
209900-183F

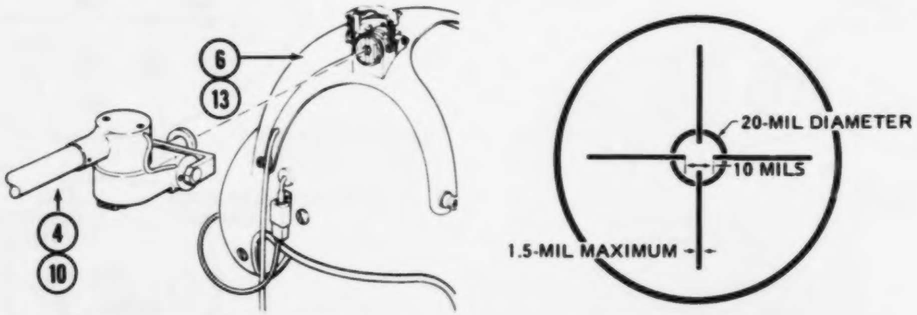
Figure 4.1-8. Wing Gun Pod


2
3
4
5
6
8
11
13
12
9
1
7
10
14

HELMET SIGHT SUBSYSTEM


11
5
4
10
16
8
12
15

PILOT/GUNNER LINKAGE ARM ATTACHMENT TO BIT MAGNET AND STOW BRACKET


6
13
4
10
20-MIL DIAMETER
10 MILS
1.5-MIL MAXIMUM

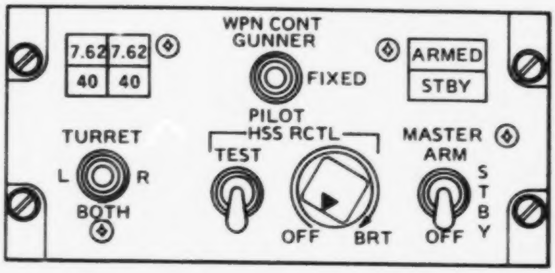
PILOT/GUNNER LINKAGE ARM ATTACHMENT TO HELMET SIGHT

PILOT/GUNNER EYEPIECE RETICLE PATTERN

209071-344A

1. Electronic interface assembly
2. Gunner extension cable
3. Pilot linkage cable
4. Pilot linkage arm
5. Pilot linkage rails
6. Pilot helmet sight
7. Pilot eyepiece
8. Pilot linkage front support
9. Gunner linkage cable
10. Gunner linkage arm
11. Gunner linkage rails
12. Gunner linkage front support
13. Gunner helmet sight
14. Gunner eyepiece
15. BIT magnet
16. Stow bracket

Figure 4.1-9. Helmet Sight Subsystem (HSS)

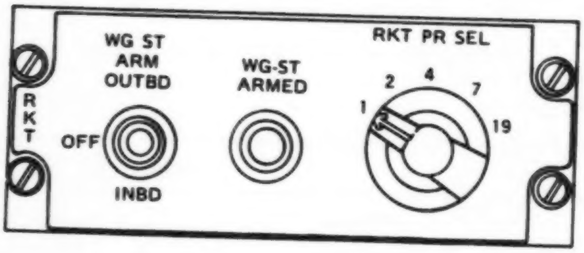


LOCATION: PILOT INSTRUMENT PANEL

ITEM	FUNCTION	
	WARNING	
	MASTER ARM switch bypassed when gunner PLT OVRD switch in OVRD.	
MASTER ARM Switch	OFF	— Deactivates all sights and weapon control/firing circuits.
	STBY	— Activates all sights, turret, and TOW missile control circuits. Charges wing gun pod battery.
	ARM	— Activates all sights and weapon control/firing circuits. Charges wing gun pod battery.
WPN CONT Switch	PILOT	— Permits pilot to fire turret using HS and wing stores (not TOW) using reflex sight.
	FIXED	— Permits pilot to fire turret and wing stores (not TOW) using reflex sight.
	GUNNER	— Permits gunner to fire turret using helmet sight or TSU and TOW using TSU.
TURRET Switch	L	— Permits pilot to fire turret left weapon (grenade launcher).
	R	— Permits pilot to fire turret right weapon (machine gun).
	BOTH	— Permits pilot to fire turret right weapon (machine gun).
HSS RTCL OFF/BRT Switch	OFF	— Deactivates pilot HS reticle lamps/ turn, Varies intensity of pilot HS reticle lamps.
HSS RTCL TEST Switch	TEST	— Tests pilot HS reticle.
ARMED/STBY Indicator	ARMED	— Indicates MASTER ARM switch in ARM (amber light).
	STBY	— Indicates MASTER ARM switch in STBY (green light).
	OFF	— Indicates MASTER ARM switch is off.
	Press	— Tests indicator lights.
7.62/7.62/40/40 Indicators	Right 7.62	— Indicates machine gun in right side of turret.
	Left 40	— Indicates grenade launcher in left side of turret.
	Left 7.62	— Inoperative.
	Right 40	— Inoperative.
	Press	— Tests indicator lights.
	Off	— Indicates pilot does not have control of the turret.

209075-295A

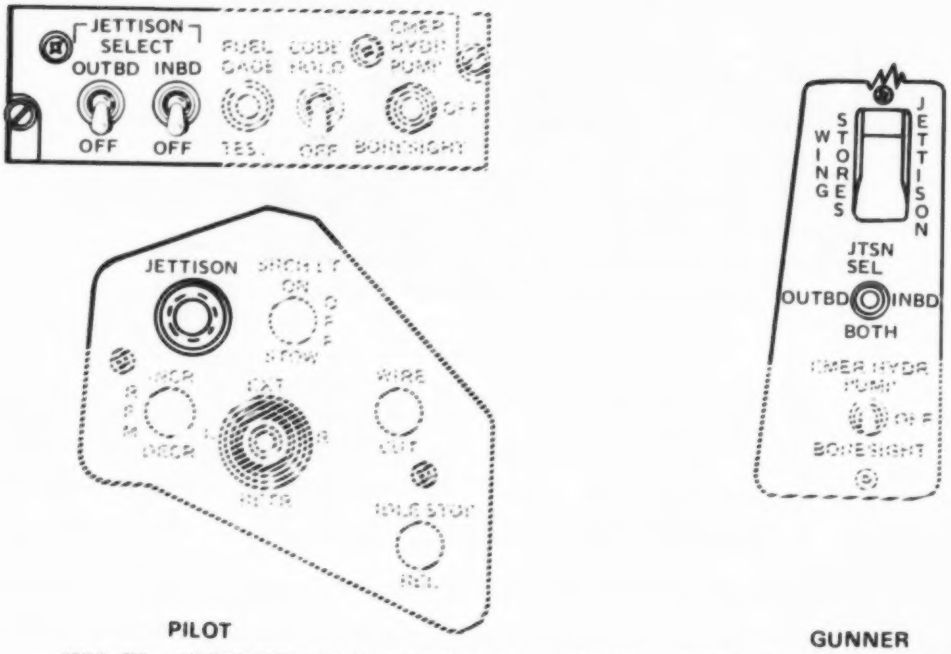
Figure 4.1-10. Pilot Armament Control Panel



ITEM	FUNCTION
WG ST ARM Switch	OFF — Deactivates rocket and wing gun pod circuits. INBD — Permits pilot to fire rockets/gun pods mounted on wing inboard ejector racks OUTBD — Permits pilot to fire rockets mounted on wing outboard ejector racks.
ARMED Indicator	OFF — Indicates WG ST ARM switch is in the OFF position. ON — Indicates WG ST ARM switch is in the INBD or OUTBD position. Turn — Varies intensity of indicator light.
RKT PR SEL Switch	Turn — Selects quantity of rocket pairs for firing.

209075-306

Figure 4.1-11. Pilot Rocket Control Panel


JETTISON
SELECT
OUTBD
INBD
OFF
OFF
FUEL GAGE
CODE HOLD
EMER HYDR PUMP
TEST
OFF
BORESIGHT
OFF
JETTISON
SIGHT LT
ON
OFF
INCR
RPM
DECR
EXT
RETR
WIRE
CUT
WING STORES
JETTISON
JTSN SEL
OUTBD
INBD
BOTH
EMER HYDR PUMP
OFF
BORESIGHT
PILOT
GUNNER

With Pilot JETTISON switch pressed or Gunner WING STORES JETTISON switch UP.

ITEM	FUNCTION	
	Jettison	
Wing Stores Jettison Select Switch	2 TOW	4 TOW
Inbd	Inbd	Both
Outbd	Outbd	Outbd
Both	Both	Both

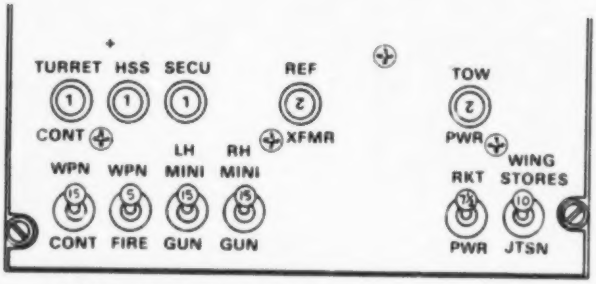
In the BOTH jettison sequence the outboard stores leave first followed by the inboard.

The electrical circuit interface will allow jettison of the inboard stores if only two missile launch tubes are installed on the outboard racks.

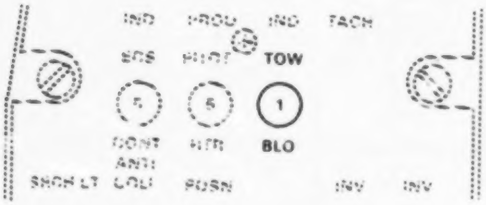
Electrical compartment jettison circuit breakers are considered to be in.

209075-324A

Figure 4.1-12. Wing Stores Jettison


TURRET
HSS
SECU
REF
TOW
1
1
1
2
2
CONT
XFMR
PWR
WPN
WPN
LH MINI
RH MINI
RKT
WING STORES
15
5
15
15
7.5
10
CONT
FIRE
GUN
GUN
PWR
JTSN

AC/ARMAMENT CIRCUIT BREAKER PANEL

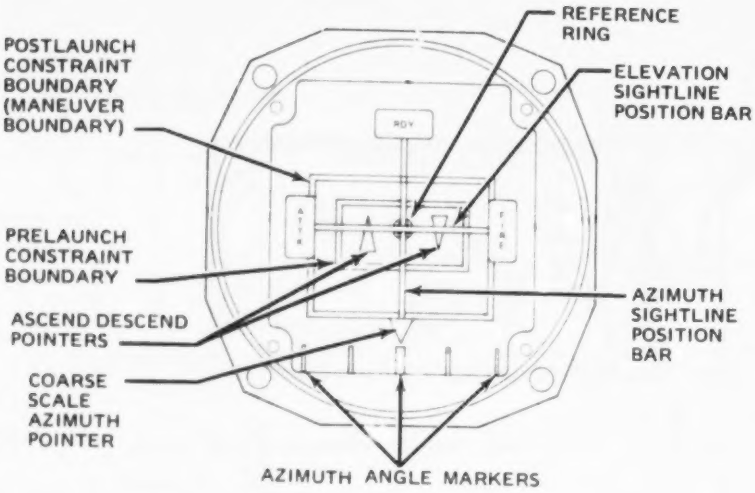

IND
PROD
IND
TACH
SCS
HTR
TOW
5
5
1
CONT
HTR
BLO
ANTI
SRCH LT
COLL
POSN
INV
INV

DC CIRCUIT BREAKER PANEL

209075-307B

Circuit Breaker	Function — Applies Power to and Protects Circuit For
TURRET CONT	Turret control.
HSS	Helmet sight subsystem.
SECU	Servo electronic control unit.
REF XFMR	Reference transformer.
TOW PWR	TOW missile firing.
WPN CONT	Weapon system hydraulic.
WPN FIRE	Turret firing.
LH MINI GUN	Left inboard wing gun pod firing.
RH MINI GUN	Right inboard wing gun pod firing.
RKT PWR	Left/right inboard/outboard rocket firing.
WING STORES JTSN	Jettison switches.

Figure 4.1-13. Pilot Armament Circuit Breakers

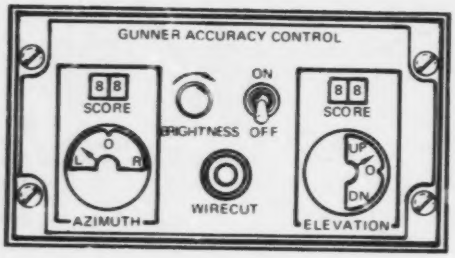

REFERENCE RING
POSTLAUNCH CONSTRAINT BOUNDARY (MANEUVER BOUNDARY)
ELEVATION SIGHTLINE POSITION BAR
RDY
ATTK
FIRE
PRELAUNCH CONSTRAINT BOUNDARY
AZIMUTH SIGHTLINE POSITION BAR
ASCEND DESCEND POINTERS
COARSE SCALE AZIMUTH POINTER
AZIMUTH ANGLE MARKERS

LOCATION: TOP OF PILOT INSTRUMENT PANEL

ITEM	FUNCTION
ATTK Annunciator	ON — Indicates TCP MODE SELECT switch is in ARMED position. All requirements for firing have been met, except pre-launch constraint.
RDY Annunciator	ON — Indicates pilot has achieved prelaunch constraints.
FIRE Annunciator	ON — Indicates trigger has been pulled and firing sequence started.
Reference Ring (Fixed)	— Represents helicopter reference axis.
Prelaunch Constraint Boundary (Fixed)	— Represents boundary within which the pilot must keep the sightline position bars prior to and during TOW launch. The boundary represents ± 2.5° azimuth and ± 6° elevation.
Postlaunch Constraint Boundary (Fixed)	— Represents boundary within which the pilot must keep the sightline position bars after TOW launch and until wire cut or missile impact.
Elevation/ Azimuth Sightline Position Bars (Moveable)	— Indicate elevation and azimuth of TSU gimbal angles with respect to helicopter reference axis (reference ring) and constraint boundaries.
Ascend Descend Pointers (Indicator)	ON — Indicates helicopter requires a nose-up or nose-down attitude to reduce the line-of-sight rate during prelaunch stage. OFF — Indicates helicopter nose-up and nose-down attitudes and line-of-sight rate are compatible.
Azimuth Angle Markers (Fixed)	— Represents TSU ± 110° azimuth limits.
Coarse Scale Azimuth Pointer (Moveable)	— Indicates azimuth of TSU gimbal angles on the azimuth angle markers.

209071-345E

Figure 4.1-14. Pilot Steering Indicator (PSI)

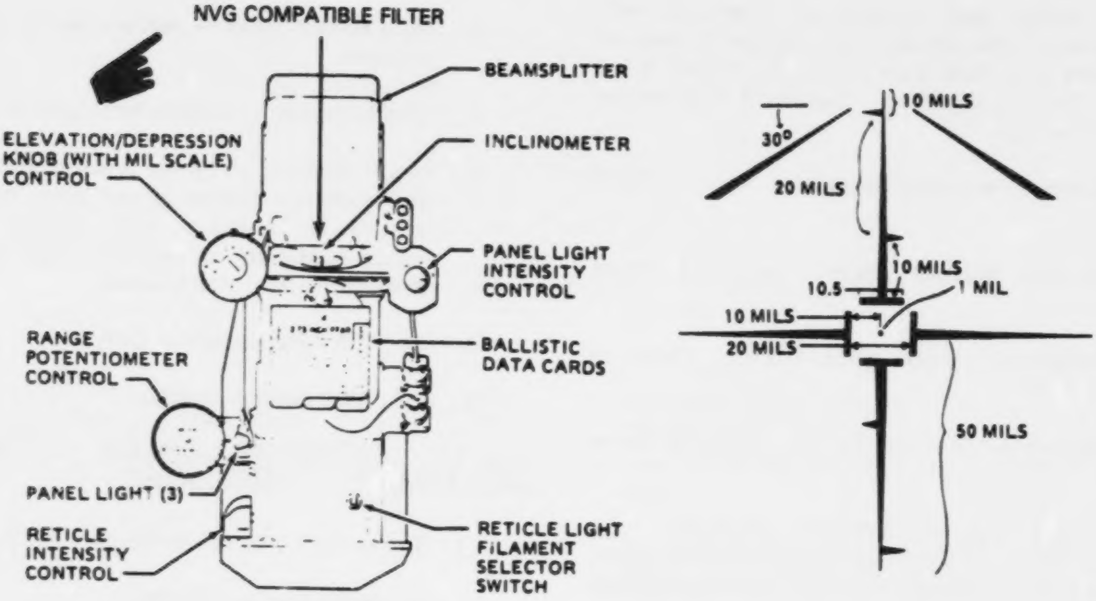

GUNNER ACCURACY CONTROL
88
SCORE
L
O
R
AZIMUTH
BRIGHTNESS
ON
OFF
WIRECUT
88
SCORE
UP
O
DN
ELEVATION

LOCATION: PILOT INSTRUMENT PANEL IF INSTALLED

ITEM	FUNCTION
ON/OFF Switch	ON — Activates gunner accuracy control circuits. — Performs built-in-test of circuits. Circuits pass test if AZIMUTH/ELEVATION SCORE indicators display 55 ± 5. OFF — Deactivates circuits.
WIRE CUT Switch	Press — Resets indicators and deactivates camera.
AZIMUTH Indicator	— Displays TSU azimuth line-of-sight.
AZIMUTH SCORE Indicator	— Displays gunner final azimuth score.
ELEVATION Indicator	— Displays TSU elevation line-of-sight.
ELEVATION SCORE Indicator	— Displays gunner final elevation score.
BRIGHTNESS Knob	Turn — Varies intensity of AZIMUTH/ELEVATION SCORE indicator lights.

209071-347B

Figure 4.1-15. Pilot Gunner Accuracy Control Panel (GACP)


NVG COMPATIBLE FILTER
BEAMSPLITTER
ELEVATION/DEPRESSION KNOB (WITH MIL SCALE) CONTROL
INCLINOMETER
PANEL LIGHT INTENSITY CONTROL
RANGE POTENTIOMETER CONTROL
BALLISTIC DATA CARDS
PANEL LIGHT (3)
RETICLE INTENSITY CONTROL
RETICLE LIGHT FILAMENT SELECTOR SWITCH
10 MILS
30°
20 MILS
10 MILS
10.5
1 MIL
10 MILS
20 MILS
50 MILS

SIGHT

RETICLE

LOCATION: TOP OF PILOT INSTRUMENT PANEL

ITEM	FUNCTION
Elevation/Depression Control	Varies angle of beamsplitter to adjust for range and airspeed when firing wing stores (not TOW) per the ballistic data cards.
Range Potentiometer Control	Applies correctional elevation signal to turret.
Reticle Intensity Control	Adjust intensity of reticle lights.
Reticle Light Filament Selector Switch	Selects one of two filaments of reticle light.
Panel Light Intensity Control	Adjust intensity of panel lights.
Inclinometer	Indicates helicopter yaw attitude.

209071-367

Figure 4.1-16. Pilot Reflex Sight

4.1-7. GUNNER SWITCHES AND INDICATORS.

Gunner panels and switches are interfaced with other gunner/pilot panels and switches for weapon operations and wing stores jettison. Figure 4.1-2 shows panel interface. Figure 4.1-3 shows switch interface.

a. **Cyclic Armament Switches.** Refer to figure 2-13.

b. **Gunner Helmet Sight.** Refer to figure 4.1-9.

c. **Telescopic Sight Unit (TSU).** Refer to figure 4.1-17.

d. **Armament Control Panel.** Refer to figure 4.1-18.

e. **Wing Stores Jettison Switch.** The guarded switch is on the gunner instrument panel. Activation of the switch will jettison all weapons from all ejector racks. The switch is powered and protected by the jettison circuit breakers in the electrical compartment.

f. **Sight Hand Control (SHC).** Refer to figure 4.1-19.

g. **TOW Control Panel (TCP).** Refer to figure 4.1-20.

4.1-8. PREFLIGHT PROCEDURES.

WARNING

Do not rotate turret or wing gun pod barrels. The machine gun will fire when rotated. The grenade launcher in the turret will fire when the barrel is pushed in.

NOTE

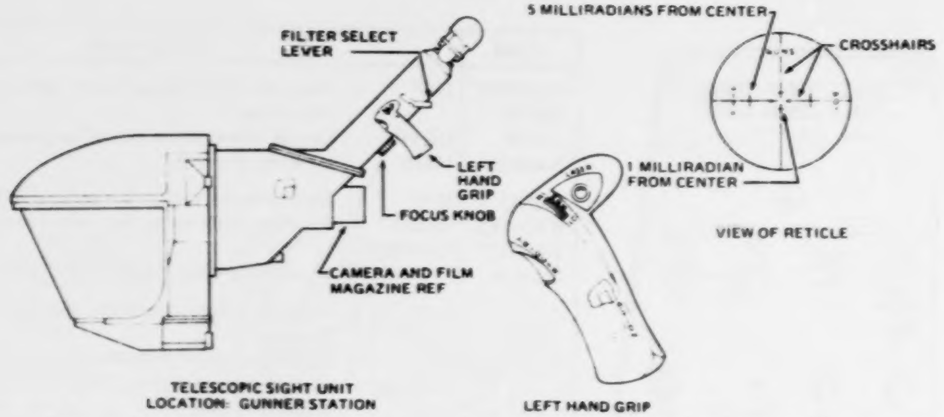
Checks herein are only applicable if the armament is installed and are in addition to those listed in Chapter 8. Chapter 4.1 does not duplicate Chapter 8 checks except for safety.

4.1-9. BEFORE EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT — SAFING PROCEDURES.

1. Wing ejector racks — Jettison safety pins installed.
2. TOW launcher — Missile arming lever up.
3. Rocket launcher — Igniter arms in contact with rockets. Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from EMI (electromagnetic interference).
4. MASTER ARM switch — OFF.
5. PLT OVRD switch — OFF.

4.1-10. EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT.

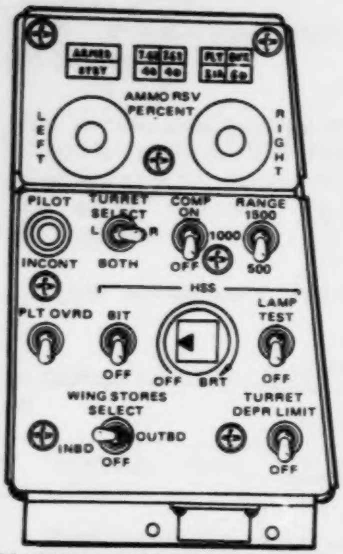
1. Turret right side (machine gun) — Check.
   - a. Bullet trap — Installed.
   - b. Access door — Open/remove.
   - c. Barrel clamp and retaining bolt — Secure.
   - d. Gun mounting — Quick-release pins (ring up) installed through gun saddle outboard holes and recoil adapters, recoil adapters secure on gun, gun support extension over saddle azimuth boresight support.
   - e. Link ejection chute — Check condition and security.
   - f. Ammunition chute — Check condition and security.
   - g. Cartridge ejection chute — Check condition and security.
   - h. Delinking feeder — Check condition and security.
   - i. Gate solenoid — Plunger returns to extended position when pressed, electrical connectors condition and security.


FILTER SELECT LEVER
LEFT HAND GRIP
FOCUS KNOB
CAMERA AND FILM MAGAZINE REF
TELESCOPIC SIGHT UNIT LOCATION: GUNNER STATION
LEFT HAND GRIP
5 MILLIRADIANS FROM CENTER
CROSSHAIRS
1 MILLIRADIAN FROM CENTER
VIEW OF RETICLE

ITEM	FUNCTION	
Left Hand Grip Switches MAG Switch	LO HI	— Magnifies target two times. — Magnifies target 13 times.
TRIGGER Switch	Press	— Fires TOW or 40mm if selected in first or second detent. — Fires turret if selected at low rate (2000 rounds per minute) in first detent. — Fires turret if selected at high rate (4000 rounds per minute) in second detent.
ACTION Switch	Press	— Activates TOW launchers. — Slaves turret to TSU gunner helmet sight.
LASER Switch		— Inoperative.
TSU Reticle		
GUNS Indicator	Flash	— Indicates TCP MODE SELECT switch in is TSU/GUN position and turret not aligned with TSU.
	Steady	— Indicates TCP MODE SELECT switch is in TSU/GUN position and turret ia aligned with TSU.
ATTK Indicator	ON	— Indicates TCP MODE SELECT switch is in ARMED position. All requirements have been met except prelaunched constraints.
RDY Indicator	ON	— Indicates pilot has achieved prelaunch constraints for TOW firing.
Filter Select Lever	MOVE	— Selects filters of different light intensities Red: Use when firing a TOW missile to reduce glare from the IR source on the missile and thus allow proper tracking of the target. Clear: To be used during low light level conditions such as hazy (smoke, fog, dust) days or under twilight conditions. Neutral Density: To be used on bright clear days or to reduce the glare reflected from bodies of water. Laser Filter: To be used during any laser ranging operations to protect the eyes from laser radiation energy.
Focus Knob	Turn	— Focus the target image.

Figure 4.1-17. Gunner Telescopic Sight Unit (TSU)

209071-349J



LOCATION: GUNNER RIGHT CONSOLE

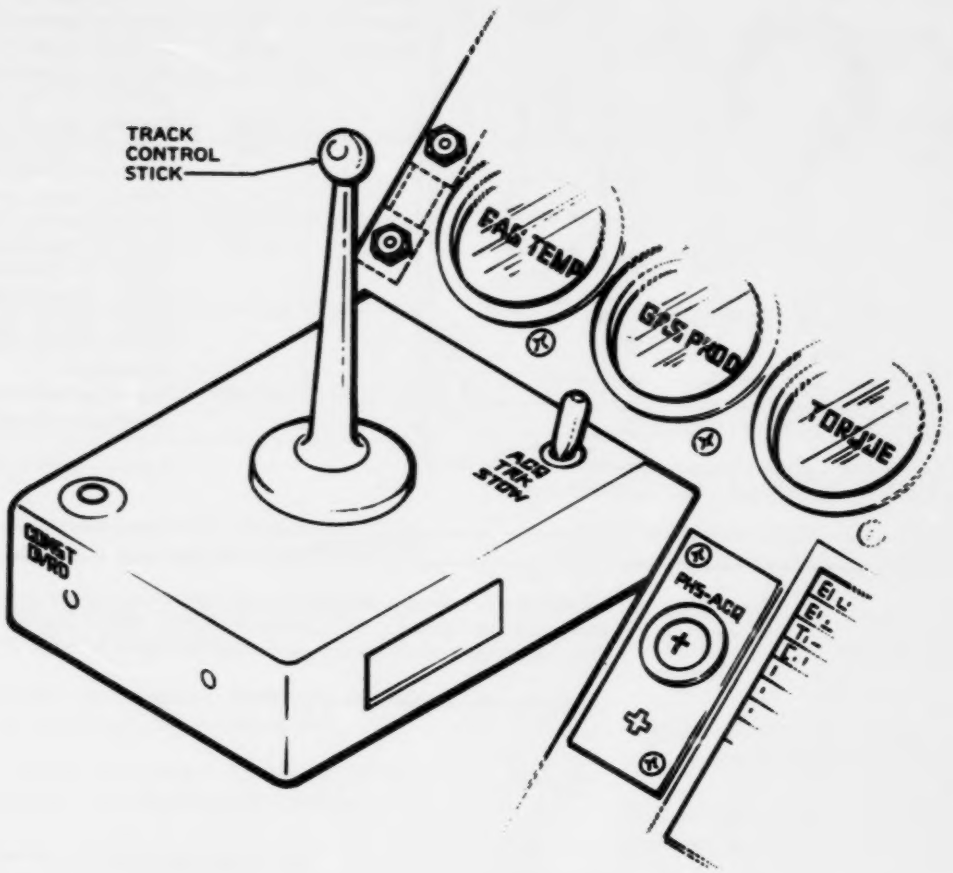
ITEM	FUNCTION	
TURRET DEPR LIMIT Switch	OFF	— Permits turret travel between minimum to maximum elevation.
	DEPR LIMIT	— Limits downward travel to prevent turret weapons from striking ground.
WING STORES SELECT Switch	OFF	— Deactivates wing stores (not TOW) circuits.
	INBD/ OUTBD	— Permits gunner to fire inboard/outboard wing stores. Functions only when PLT OVRD switch in OVRD.
PLT OVRD Switch	OFF	— Permits pilot armament control panel to control the weapons.
	PLT OVRD	— Overrides pilot armament control panel. Permits gunner to fire turret using HSS, and wing stores (not TOW) without sight.
HSS BIT Switch	OFF	— Deactivates pilot and gunner HSS built-in test circuit.
	BIT	— Tests pilot and gunner HSS when linkage arms attached to BIT magnets.
HSS RETICLE OFF/BRT Switch	OFF	— Deactivates gunner HSS reticle lights. Varies intensity of gunner HSS reticle lights when turned

ITEM	FUNCTION	
HSS RETICLE TEST Switch	TEST	— Tests gunner HSS reticle.
RANGE Switch	500/ 1000/ 1500	— Provides meters to target data to compensation circuit.
COMP Switch	OFF	— Deactivates turret positioning circuits.
	ON	— Applies airspeed/range data to turret positioning circuits.
TURRET SELECT Switch	L	— Permits gunner to fire turret left weapon (grenade launcher).
	R	— Permits gunner to fire turret right weapon (machine gun).
	BOTH	— Permits gunner to fire turret right weapon (machine gun).
PILOT IN CONT Indicator	ON	— Pilot has control of turret.
	OFF	— Gunner has control of turret or pilot MASTER ARM switch is OFF.
AMMO RSV PERCENT	Gradations	— Indicates percentage of ammunition remaining for each turret weapon.

ITEM	FUNCTION	
Indicators	RESET	— Permits pointers to be positioned to reflect initial percentage.
PLT/ GNR/ EIA/ GO Indicators	PLT	— Indicates failure in pilot helmet linkage.
	GNR	— Indicates failure in gunner helmet linkage.
	EIA	— Indicates failure in electronic interface assembly.
	GO	— Indicates HSS operating properly.
	Press	— Tests indicator lights
	Off	— Indicates HSS built-in-test not being conducted.
7.62/ 7.62./ 40/40 Indicators	Right 7.62	— Indicates machine gun in right side of turret.
	Left 40	— Indicates grenade launcher in left side of turret.
	Left 7.62	— Inoperative.
	Right 40	— Inoperative.
	Press	— Tests indicator lights.
	Off	— Indicates gunner does not have control of turret.
ARMED/ STBY Indicator	ARMED	— Indicates pilot MASTER ARM switch in ARM (red light).
	STBY	— Indicates pilot MASTER ARM switch in STBY (green light).
	Off	— Indicates pilot MASTER ARM switch is off. Tests indicator lights. when pressed.

209075-293C

Figure 4.1-18. Gunner Armament Control Panel

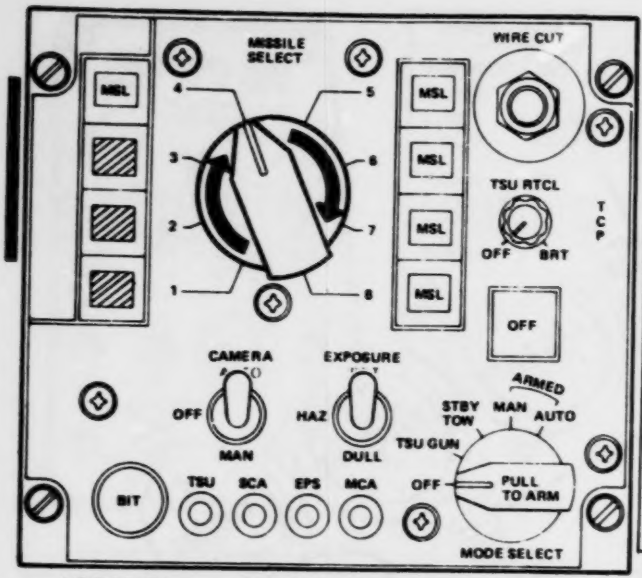

TRACK
CONTROL
STICK
GAS TEMP
GAS PROD
TORQUE
ACQ
TRK
STOW
CONST
OVRD
PHS-ACQ

LOCATION: GUNNER INSTRUMENT PANEL

ITEM	FUNCTION
Track Control Stick	Positions TSU in azimuth and elevation.
ACQ/TRK/STOW Switch	ACQ — Slaves TSU to gunner HS for target acquisition. TRK — Permits track control handle to position TSU. — Permits pilot to perform target acquisition. STOW — Stows TSU dead-ahead.
PHS ACQ Switch Located on Instrument Panel	Slaves TSU to pilot HS for target acquisition when pressed.
CONST OVRD Switch	Permits TOW firing when helicopter is not aligned within the attack envelope when pressed.

209071-350B

Figure 4.1-19. Gunner Sight Hand Control (SHC)



LOCATION: GUNNER INSTRUMENT PANEL

ITEM	FUNCTION
MODE SELECT Switch	OFF — Deactivates TSU and TMS circuits. TSU/ GUN — Permits gunner to fire turret and perform target acquisition, pilot to fire wing stores (not TOW) and perform target acquisition. STBY TOW — Permits gunner to control TMS/ perform target acquisition, pilot to fire turret/ wing stores (not TOW) and perform target acquisition. MAN — Permits gunner to fire TOW (manually selected) and perform target acquisition, pilot to fire turret/ wing stores (not TOW) and perform target acquisition. AUTO — Same as MAN except missile is automatically selected.

ITEM	FUNCTION
TSU/SCA/ EPS/MCA Unit Fail Indicators	Black Flag — Indicates unit operational during performance or built-in-test. White Flag — Indicates unit failure during performance or built-in-test. EPS indicates failure during performance, built-in-test, or nonperformance.
BIT Switch	Performs manual built-in-test when pressed.
CAMERA Switch	Not used.
EXPOSURE Switch	Not used.
OFF/PWR ON/ ARMED/TEST System Status Annunciator	OFF — Indicates MODE SELECT switch is in the OFF position. PWR ON — Indicates MODE SELECT switch is in the TSU/GUN or STBY TOW position. ARMED — Indicates MODE SELECT switch is in the ARMED position. TEST — Indicates built-in-test is being performed.
TSU RTCL Switch	OFF — Deactivates the TSU reticle circuit. Varies intensity of TSU reticle lights when turned.
WIRE CUT Switch	Permits gunner to manual cut missile command wire when pressed.
MSL/Barberpole Missile Status Indicators	MSL — Indicates missile is present in a specific location of launcher. Barberpole — Indicates missile is not present in a specific location of launcher.
MISSILE SELECT Switch	1/2/3/4/ 5/6/7/8 — Indicates missile selected (manual or automatic) for firing.

209071-368C

Figure 4.1-20. Gunner TOW Control Panel (TCP)

j. Gun drive — Flexible shaft and electrical connectors condition and security.

k. Gun timing pin — Set.

l. Delinking feeder timing — Set.

m. Hydraulic lines — Check condition and security.

n. Access door — Close/replace and secure.

o. Telescopic sight unit — Cover removed and window clean.

2. Ammunition bay right side (machine gun) — Check.

   a. Bay door — Open.

   b. Ammunition drum — Check condition and secure with quick-release pins.

   c. Flexible shaft — Check condition and secure to torque limiter.

   d. Round counter — Check condition and electrical cable connected.

   e. Ammunition chute — Check condition, security, and ammunition present.

   f. Turret circuit breakers — In.

   g. Hydraulic/electrical lines — Check condition and security.

   h. Bay door — Close and secure.

3. Turret left side (grenade launcher) — Check.

   a. Access door — Open/remove.

   b. Gun cradle mounting — Quick-release pins (ring up) installed through gun saddle inboard holes and recoil adapters, recoil adapters secure on cradle, cradle rear bushing over saddle azimuth boresight support.

   c. Launcher mounting — Check launcher front support rollers in gun cradle forks, launcher rear secure to cradle with bolts.

   d. Ammunition chute/feed tray — Check condition, security, and ammunition present.

   e. Ejection chute — Check condition and security.

   f. Gun drive — Check flexible shaft and electrical connectors condition and security.

   g. Hydraulic lines — Check condition and security.

   h. Access door — Close/replace and secure.

4. Ammunition bay left side (grenade launcher) — Check.

   a. Bay door — Open.

   b. Ammunition drum — Check condition and secure with quick-release pins.

   c. Drive motor — Check condition, security, and electrical cable connected.

   d. Round counter — Check condition and electrical cable connected.

   e. Ammunition chute — Check condition, security, and ammunition present.

   f. Hydraulic/electrical lines — Check condition and security.

   g. Bay door — Close and secure.

5. Machine gun bullet trap — Remove.

(O) 6. Exterior check (TOW) — Check.

   a. Launcher mounting — Check upper launcher aft and forward adjustable bomb lugs secure to helicopter ejector racks and rack swaybrace bolts firmly against launcher swaybrace pads. Lower launcher aft and forward attaching points secure to upper launcher aft and forward attaching points.

   b. Electrical connector — Check upper launcher harness connected to helicopter receptacle and jettison quick disconnect lanyard attached to harness and launcher. Lower launcher harness connected to upper launcher harness receptacle.

c. Missile installation — Check missile front ring seated in forward tube mating ring, hinged center gate and debris director secure with captive locking pins. Note number of and position of installed missiles (needed for interior check).

(O) 7. Exterior check (rocket launcher) — Check.

a. Launcher mounting — Check launcher aft and forward bomb suspension lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against launcher but not denting exterior.

b. Electrical connection — Check harness connected to launcher and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and launcher.

c. Launcher — Check launcher exterior and tube interiors for damage and corrosion.

d. Rocket installation — Check rocket aft end secure in launcher tube aft detent.

e. Igniter arms — Check for damage and corrosion.

(O) 8. Exterior check (wing gun pod) — Check.

a. Front fairing — Removed.

b. Bullet trap — Installed.

c, Pod mounting — Check pod front and rear lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against pod but not denting exterior.

d. Electrical connection — Check harness connected to pod and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and pod.

e. Pod — Check pod exterior for condition (includes front fairing removed during Before Exterior Check).

f. Gun barrel clamp and retaining bolt — Check secure.

g. Gun mounting — Check recoil adapters, quick release pins and rear mount secure.

h. Gun gate solenoid — Check plunger returns to extended position when pressed, electrical connectors condition and security.

i. Gun exit unit — Check condition and security.

j. Gun feeder wheel — Check condition and security.

k. Gun electrical drive — Check drive and electrical connectors condition and security.

l. Gun safing sector — Secure.

m. Gun round counters (2) — Set.

n. Gun timing pin — Set.

o. Gun feeding timing pin — Set.

p. Gun exit unit timing pin — Set.

q. Rear fairing — Remove.

r. CHGR switch — AUTO.

s. HTR switch — As desired.

(O) t. Firing RATE selector switch — As desired.

(O) u. FLD power start switch — BAT.

v. Battery — Check for damage, leaking cells, and corosion.

w. Rear fairing — Replace and secure.

x. Bullet trap — Remove.

y. Front fairing — Replace and secure.

4.1-11. BEFORE STARTING ENGINE CHECK.

NOTE

Check is to be performed after BEFORE STARTING ENGINE CHECK, Chapter 8.

1. Armament switches — Set.
   a. Pilot PSI — Elevation/azimuth sightline position bars centered on reference ring, coarse scale azimuth pointer centered. ATTK/RDY/FIRE annunciators and ascent/descent pointers not displayed.
   b. Gunner SHC ACQ/TRK/STOW switch — STOW.
   c. Gunner TCP MODE SELECT switch — OFF, system status annunciator displays OFF.
   d. Gunner TCP CAMERA switch — OFF.
   e. Gunner TCP EXPOSURE switch — BRT.
   f. Gunner TCP TSU RTCL switch — OFF.
   g. Gunner TCP MISSILE SELECT switch—As desired.
   h. Gunner AMMO RSV PERCENT dials — Set.

4.1-12. ARMAMENT — SYSTEMS CHECK.

WARNING

The following checks shall not be performed with TOW missiles installed.

NOTE

Hydraulic power is required for portions of the check.

1. HSS built-in-test — Check.
   a. Pilot and gunner HS arm assemblies — Attached to BIT magnets.
   b. Pilot MASTER ARM switch — STBY.
   c. Pilot WPN CONT switch — GUNNER.
   d. Pilot TURRET switch — BOTH.
   e. Indicator light test — Press pilot and gunner ARMED/STDY, 7.62/7.62/40/40, and gunner PLT/GUNNER/EIA/GO panels. All sections illuminate.
   f. Gunner HSS BIT switch — BIT. Test passed if GO light illuminates; failed if PLT/GNR/EIA lights illuminate. If failed, ensure HSS arm assemblies are properly attached to BIT magnets, check all cables connections, and actuate BIT switch again.

NOTE

If failure occurs, recycle MASTER ARM switch and do not use failed station.

2. HSS to turret — Check.
   a. Pilot and gunner HS arm assemblies — Attach to helmet.
   b. Pilot and gunner HS eyepieces — Extended over eye.
   c. Gunner reticle — Adjust, focus, and test lights. HSS OFF BRT control to be in full BRT. After adjust and focus, move HSS LAMP TEST switch to TEST. If reticle goes out, one or more lights may have failed.

CAUTION

Do not drive turret to stops during this check.

   d. Gunner HS to turret check — TSU left hand grip ACTION switch depressed, gunner moves head, turret follows head movement. Gunner makes rapid rotational head movement, reticle flashes until gun line is coincident with HS line. Release ACTION switch.

WARNING

In the following check, do not press the gunner cyclic TRIGGER TURRET FIRE switch.

e. Gunner emergency mode check — Gunner PLT OVRD switch is OVRD and cyclic TRIGGER ACTION switch depressed, repeat step 4. above, then PLT OVRD switch to OFF.

f. Pilot WPN CONT switch — PILOT. Pilot reticle — Adjust, focus, and test lights. HSS RTCL OFF BRT control to be in full BRT. After adjust and focus, move HSS RTCL TEST switch to TEST. If reticle goes out, one or more lights may have failed.

g. Pilot HS to turret check — Cyclic TRIGGER ACTION switch depressed, pilot moves head, turret follows head movement. Pilot makes rapid rotational head movement, reticle flashes until gun line is coincident with HS line. Release TRIGGER ACTION switch.

3. TOW built-in-test — Check.

a. Pilot WPN CONT switch — GUNNER.

b. Gunner TCP MODE SELECT switch — STBY TOW, system status annunciator OFF, after 10 seconds, TEST, before two minutes PWR ON, TSU/SCA/EPS/MCA fail indicators display black flags. Black flag indicates automatic BIT passed, white flag indicates failure.

c. Gunner TCP BIT switch — Hold, gunner TSU reticle ATTK/RDY/GUNS indicators, pilot PSI ATTK/RDY/FIRE annunciators, and ascend/descend pointers displayed. Release switch.

d. Gunner TCP missile status indicators — Displays missile load configuration noted during exterior check.

e. BIT override check — TCP MODE SELECT switch OFF, then STBY TOW, when TCP annunciator displays TEST, move ACQ/TRK/STOW switch from STOW to TRK, annunciator displays PWR ON.

f. TOW BIT (performed above) information — Automatic or manual BIT may be performed before, during, or after operations.

(1) TOW BIT initiation.

(a) Gunner SCH ACQ/TRK/STOW switch — STOW.

(b) Automatic BIT — Gunner TCP MODE SELECT switch from OFF to TSU/GUN or STBY TOW.

(c) Manual BIT — When gunner TCP system status annunciator displays PWR ON, press and release TCP BIT switch. In the event of a BIT failure repeat as many times as necessary to verify failure.

(2) TOW BIT termination.

(a) Automatic or manual BIT — Automatically completed within two minutes.

(b) Termination during BIT — Gunner SHC ACQ/TRK/STOW switch set to ACQ or TRK or TCP MODE SELECT switch set to MAN ARMED, AUTO ARMED, or OFF.

4. TSU fast rate tracking — Check.

a. Focus knob — Rotate counterclockwise to stop.

b. Gunner — Look into TSU eyepiece.

c. TCP MODE SELECT switch — STBY TOW.

d. SHC ACQ/TRK/STOW switch — TRK.

e. LHG MAG switch — HI. Switch must be positively held in position before releasing. TSU eyepiece displays high magnification (13 power) of target.

f. Focuc knob — Rotate clockwise until focus is obtained.

g. LHG MAG switch — LO. Switch must be positively held in position before releasing. TSU eyepiece displays low magnification (two power) of target.

h. SHC track control stick — Move full left and down. TSU rapidly moves left and down.

i. SHC track control stick — Release. TSU view not rotating. Pilot PSI azimuth sight-line position bar and coarse scale azimuth pointer full left, elevation sightline position bar full down.

5. TSU slow rate tracking — Check.

   a. Gunner — Look into TSU eyepiece during check.

   b. Mode switch — STBY TOW.

   c. LHG MAG switch — HI. Switch must be positively held in position before releasing. TSU eyepiece displays high magnification (13 power) of target.

   d. SHC track control stick — Move full right and up. TSU slowly moves right and up.

   e. SHC track control stick — Release TSU view not rotating. Pilot azimuth sightline position bar and course scale azimuth pointer full right, elevation sightline position bar full up.

6. TOW motion compensation — Check.

   a. Gunner — Look into TSU eyepiece during check.

   b. LHG ACTION switch — Press.

   c. SHC track control stick — Move left and down. Release when TSU starts moving, TSU continue to move.

   d. LHG action switch — Release. TSU stops.

7. TSU stow position and reticle — Check.

   a. Gunner — Look into TSU eyepiece during check.

   b. TCP RTCL switch — Rotate. Reticle light intensity varies.

   c. SHC ACQ/TRK/STOW switch — STOW. TSU returns to stow position.

8. HSS to TSU — Check.

   a. Pilot and gunner HS eyepieces — Extended over eye.

   b. Gunner HS reticle — On a target

   c. SHC ACQ/TRK/STOW switch — ACQ.

   d. SHC ACQ/TRK/STOW switch — Released. Returns to TRK. Gunner HS eyepiece retracts.

   e. Gunner HS eyepiece — Extended over eye.

   f. TSU reticle — Displayed target.

   g. Pilot HS reticle — On another target.

   h. PHS ACQ switch — Press. Gunner HS eyepiece retracts.

   i. TSU reticle — Displays pilot target.

   j. PHS ACQ switch — Released.

4.1-13. BEFORE TAKEOFF CHECK — ALL ARMAMENT.

1. Gunner PLT OVRD switch — OFF.
2. Pilot MASTER ARM switch — STBY.
3. TCP — TSU/GUN.
4. TOW launchers — Missile arming lever down.
5. Wing ejector rack jettison safety pins — Removed.

4.1-14. INFLIGHT PROCEDURES — ALL ARMAMENT.

The following armament inflight procedure paragraphs are based on only one weapon installed, all armament circuit breakers in, and armament preflight interior check performed. Refer to figure 4.1-3 for firing modes when two or more weapons are installed.

4.1-15. TURRET OPERATION — INFLIGHT PROCEDURES.

1. Gunner operation (turret) is accomplished as follows:

   a. Pilot MASTER ARM switch — ARM.

   b. Pilot WPN CONT switch — GUNNER.

   c. Pilot TURRET switch — As desired.

   d. Gunner PLT OVRD switch — OFF.

e. Gunner RANGE switch — As desired.

f. Gunner COMP switch — ON.

g. Gunner TURRET DEPR LIMIT switch — OFF.

h. Gunner TCP MODE SELECT switch—OFF/TSU/GUN with ATS switch to STOW when using helmet sight (HS). TSU/GUN when using TSU, ATS must be in TRACK.

i. Gunner LHG ACTION switch — Pressed.

j. Gunner HS/TSU reticle — ON target.

k. Gunner LHG TRIGGER switch — Pressed. Machine gun — First detent 2000 rounds per minute, second detent 4000. Grenade launcher — First or second detent 400 grenades per minute.

l. Emergency procedures — Refer to paragraph 9-53.

2. Pilot operation is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONT switch — PILOT when using helmet sight (HS), FIXED when using reflex sight.

c. Pilot TURRET switch — As desired.

d. Gunner PLT OVRD switch — OFF.

e. Gunner RANGE switch — As desired.

f. Gunner COMP switch — ON.

g. Gunner TURRET DEPR LIMIT switch — OFF.

h. Pilot reflex sight — Set when using reflex sight.

i. Pilot cyclic TRIGGER ACTION switch — Pressed when using HS.

j. Pilot HS/reflex sight reticle — On target.

k. Pilot cyclic TRIGGER TURRET FIRE switch — Pressed. Machine gun — First detent 2000 rounds per minute, second detent 4000. Grenade launcher — First or second detent 400 grenades per minute.

l. Emergency procedures — Refer to paragraph 9-53.

4.1-16. TOW OPERATION — INFLIGHT PROCEDURES.

1. TOW firing is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONT switch — GUNNER.

c. Gunner TCP MODE SELECT switch — ARMED MAN for manual missile selection, ARMED AUTO for automatic missile selection. TOW system requires two minutes to warm up. TCP system status annunciator displays ARMED.

d. Gunner TSU LHG MAG switch — LO. Switch must be positively held in position before releasing.

e. Gunner TSU RTCL knob — As desired.

f. Gunner TSU reticle — Focus.

g. Gunner TCP MISSILE SELECT switch — Set to first loaded missile, pilot informed of missile selected.

h. Gunner HS reticle — On target.

i. Gunner SHC ACQ/TRK/STOW switch — ACQ.

j. Gunner SHC ACQ/TRK/STOW switch — TRK.

k. Gunner TSU reticle — On target.

l. Gunner TSU LHG MAG switch — HI. Switch must be positively held in position before releasing.

m. Gunner SHC track control stick — Move as required to keep TSU crosshairs on target.

n. Gunner TSU LHG ACTION switch — Pressed. Gunner TSU reticle ATTK indicator comes on, pilot PSI ATTK annunciator appears. Keeping the TSU LHG ACTION switch pressed provides motion compensation by the TSU for a target during tracking.

o. Helicopter position — Manuevered to align pilot PSI sightline position bars within prelaunch constraint boundary and maintained a roll attitude of less than ±5°. Gunner TSU reticle RDY indicator comes on, pilot PSI RDY annunicator appears.

p. Gunner TSU LHG TRIGGER switch — Pressed when helicopter is within range of target. Pilot PSI FIRE annunciator appear. After 1.5 seconds, pilot PSI ATTK and RDY annunicators disappear, gunner TSU reticle ATTK and RDY indicators disappear. Gunner cannot fire if the helicopter is not within the prelaunch constraint boundary. Gunner can override the prelaunch constraint boundary limitation by pressing the CONST OVRD switch in the SHC. If this mode of operation is employed, degraded system performance can be expected. Smoke may emerge from launcher after TRIGGER is pressed and before missile exits launcher. The smoke is caused by the missile gyro and battery squibs firing and should not be regarded as a misfire. A misfire has occured if missile fails to exit launcher within 1.5 seconds (pilot PSI RDY annunciator disappears). After missile firing release TSU LHG TRIGGER switch. Do not press the LHG TRIGGER during wire cutting because another missile will be launched if the TCP MODE SELECT switch is in the ARMED AUTO position and the helicopter is within prelaunch constraints.

WARNING

Do not turn helicopter to the side from which a missile is fired. The helicopter may strike the command wire.

q. Helicopter position — Maneuvered to keep pilot PSI sightline position bars within prelaunch constraint boundary until wire cut or missile impact.

CAUTION

Loss of missile guidance could result if a manuever exceeding postlaunch constraint boundary is made.

Firing TOW missile over high voltage lines may result in damage to TOW system.

r. Gunner TSU reticle crosshairs — On target until wire cut or missile impact. Gunner SHC track control stick used to keep crosshairs on target.

s. WIRE CUT button — Press.

t. Additional missile firing — The next missile is selected automatically if the gunner TCP MODE SELECT switch is on ARMED AUTO, manually selected if switch is on ARMED MAN by the MISSILE SELECT switch.

(1) Gunner TSU LHG MAG switch — LO. Switch must be positively held in position before releasing.

(2) ACQ/TRQ/STOW switch — STOW.

(3) Fire missile — Repeat paragraphs 4.1-16.i through 4.1-16.t.

u. Emergency procedures — Refer to paragraph 9-52.

4.1-17. ROCKET OPERATION — IN-FLIGHT PROCEDURES.

1. Rocket firing is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Gunner PLT OVRD switch — OFF.

c. Pilot RKT PR SEL switch — As desired.

d. Pilot WG ST ARM switch — As required. ARMED indicator comes on.

e. Pilot REFLEX sight—Adjust and align with target.

f. Pilot cyclic WING ARM FIRE switch — Pressed.

4.1-18. WING GUN POD OPERATION — INFLIGHT PROCEDURES.

1. Wing gun pod firing is accomplished as follows:

   a. Pilot MASTER ARM switch — ARM.

   b. Gunner PLT OVRD switch — OFF.

WARNING

If rockets are being fired, the pilot cyclic WING ARM FIRE switch must be released prior to moving WG ST ARM switch from OUTBD to INBD. WING gun pod rounds may detonate inflight rockets in proximity of helicopter.

   c. Pilot WG ST ARM switch — INBD. ARMED indicator comes on.

   d. Pilot reflex sight — Adjust and align with target.

   e. Pilot cyclic WING ARM FIRE switch — Pressed.

4.1-19. WING STORES JETTISON — INFLIGHT PROCEDURES.

Refer to Chapter 9, Section I.

4.1-20. BEFORE LANDING CHECK — ALL ARMAMENT.

1. Gunner PLT OVRD switch — OFF.
2. Pilot MASTER ARM switch—STBY.
3. TCP—TSU/GUN.

4.1-21. BEFORE LEAVING HELICOPTER CHECK — ALL ARMAMENT.

WARNING

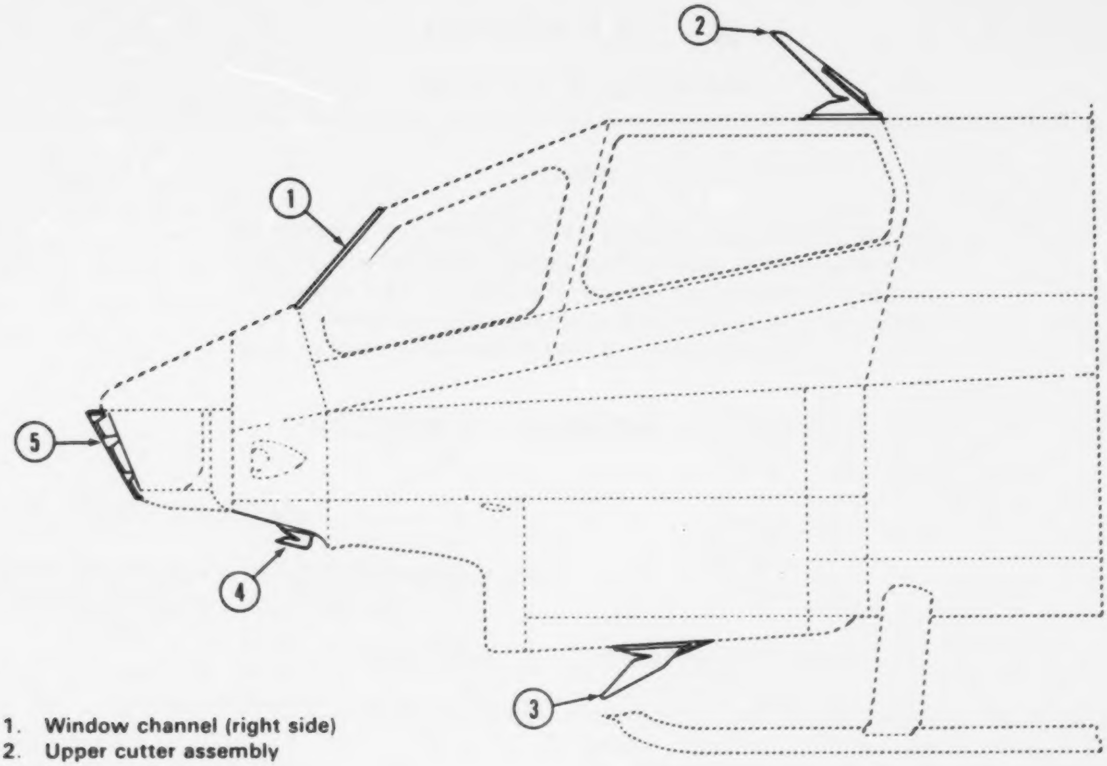
Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from EMI (electromagnetic interference).

1. Wing ejector rack jettison safety pins — Installed.
2. TOW missile arming lever — Up.
3. Rocket igniter arms — In contact with rockets. Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from electromagnetic interference (EMI).

SECTION III. PASSIVE DEFENSE

4.1-22. WIRE STRIKE PROTECTION SYSTEM.

The wire strike protection system (figure 4.1-21) consists of three cutter assemblies, a windshield channel and a nose deflector. An upper cutter assembly is mounted on top of the pilot station, forward of the ADF loop antenna. A chin cutter assembly is mounted under the nose, just forward of the gunner station. A lower cutter assembly is mounted on the forward fuselage, under the ammunition compartment. The wire strike protection system is designed to protect the helicopter from wire obstructions at low levels of flight.



1. Window channel (right side)
2. Upper cutter assembly
3. Lower cutter assembly
4. Chin cutter assembly
5. Nose deflector

209704-25

Figure 4.1-21. Wire Strike Protection System

CHAPTER 4.2 E

MISSION EQUIPMENT

NOTE

Paragraphs 4-1 through 4-23 provide information for the AH- 1F (Modernized Cobra) helicopters. Paragraphs 4.1-1 through 4.1-22 provide information for the AH-1P (Production) helicopters. Paragraphs 4.2-1 through 4.2-22 provide information for the AH-1E (ECAS) helicopters.

SECTION I. MISSION AVIONICS

4.2-1. GUN CAMERA.

Complete provisions are provided for installation of a gun camera in the telescopic sight unit.

SECTION II. ARMAMENT

4.2-2. AUTHORIZED ARMAMENT CONFIGURATIONS.

Figure 4.2-1 shows the authorized armament loading configurations.

4.2-3. INTERRELATION OF ARMAMENT.

The armament subsystems are interfaced with one another. Figure 4.2-2 shows the pilot and gunner control components in relationship to each armament subsystem.

4.2-4. ARMAMENT FIRING MODES.

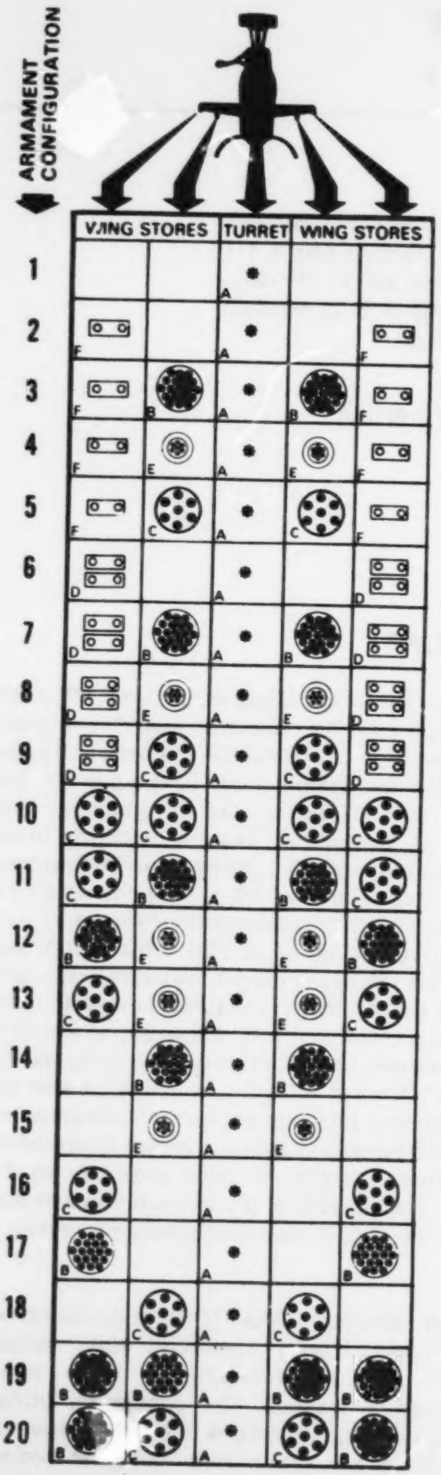
Figure 4.2-3 shows the switch positions for principal firing modes.

4.2-5. ARMAMENT DESCRIPTION.

a. Universal Turret. The universal turret system (figure 4.2-4) (TM 9-1090-206-12) provides for positioning, sighting, ammunition feeding and firing of the M197 20 mm gun. The system consists of a turret assembly, turret control unit, logic control unit, pressure transducer, ammunition feed system with booster assembly, gun control unit, recoil assembly, slider assembly, and gun drive assembly.

The turret is operated by 28vdc and 115vac, 400 hertz power provided by the helicopter electrical system. The turret weapon can be fired in the fixed or flexible mode by the pilot, flexible mode by the gunner. The turret can travel 110 degrees left or right in azimuth and 13 to 21 degrees up (varying with the turret azimuth position) and 50 degrees down in elevation. The turret fires a burst of 16 ± 4 rounds when the cyclic trigger switch is pressed to the first detent, and fires a continuous burst at 730 ± 50 rounds per minute when the cyclic trigger switch is pressed to the second detent. When the turret is slewed more than five degrees in azimuth, and an action switch is pressed to enable firing rockets or TOW missiles, the wing stores lockout circuitry is activated and the turret will stow to zero degrees azimuth and elevation to preclude the possibility of a turret round detonating the rockets or missile in close proximity to the helicopter. The capacity of the ammunition and feed is 750 rounds of continuously belted ammunition.

b. TOW Missile. The TOW (tube-launched, optically-tracked, wire command link) missile subsystem (TM 9-1425-473-20) is a heavy antitank/assault weapon. The subsystem utilizes optical and IR (infrared) means to track a target and guide the missile. Isolation from helicopter motions and vibrations is provided. One or two TML (TOW Missile Launcher) (figure 4.2-5) support two missiles each on the outboard ejector racks.

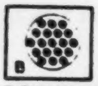


ARMAMENT CONFIGURATION	WING STORES		TURRET	WING STORES	
1			A		
2	F		A		F
3	F	B	A	B	F
4	F	E	A	E	F
5	F	C	A	C	F
6	D		A		D
7	D	B	A	B	D
8	D	E	A	E	D
9	D	C	A	C	D
10	C	C	A	C	C
11	C	B	A	B	C
12	B	E	A	E	B
13	C	E	A	E	C
14		B	A	B	
15		E	A	E	
16	C		A		C
17	B		A		B
18		C	A	C	
19	B	B	A	B	B
20	B	C	A	C	B

A

UNIVERSAL TURRET
(M-197 20MM AUTOMATIC GUN)

B



ROCKET LAUNCHER – M200A1
19 TUBE M261

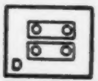
CAUTION

The 19 tube rocket launcher is restricted to a maximum of twelve (12) seventeen (17) pound warhead rockets when mounted on outboard pylons. Refer to Chapter 6 for restrictions on other combinations.

C

ROCKET LAUNCHER – M158
7 TUBE M260

D

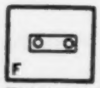


TOW MISSILE –
M65 – TWO LAUNCHERS
(FOUR MISSILES)

E

WING GUN POD – M18 OR M18A1
(7.62MM GUN)

F



TOW MISSILE
M65 – ONE LAUNCHER
(TWO MISSILES)

Figure 4.2-1. Authorized Armament Configuration

CONTROL COMPONENTS	TURRET	TOW MISSILE	WING STORES		TARGET ACQUIRE FOR TSU	WING STORES JETTISON
			ROCKETS	GUN POD		
Pilot Station						
Armament Control Panel	X	X	X	X	X	
Rocket Management System			X			
Misc Control Panel						X
Wing Stores Jettison Switch						X
Pilot Steering Indicator		X				
Reflex Sight	X		X	X		
Helmet Sight	X				X	
Cyclic Switches	X		X	X		
Gunner Station						
Cyclic Switches	X		X	X		
Helmet Sight	X				X	
Telescopic Sight Unit	X	X				
Left-Hand Grip	X	X				
Armament Control Panel	X		X	X		
Wing Stores Jettison Switch						X
Sight Hand Control	X	X			X	
TOW Control Panel	X	X			X	

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Figure 4.2-2. Control Components in Relationship to Armament Subsystem

ARMAMENT CONFIGURATION 1

PILOT SWITCHES				GUNNER SWITCHES					GUNNER	PILOT	CAN		USING	
MASTER ARM	WPN CONTR	WING STORE	ZONE ARM	PLT ORIDE	WING STORE	MODE SELECT	ACQ TRK STOW	PHS ACQ			FIRE	ACQ TGT FOR TSU	SIGHT	WPN TRIG ON
ARM	GUNNER			OFF		OFF			Gnr		Tur		HS	LHG
						TSU/GUN	STOW		Gnr		Tur		HS	LHG
							TRK		Gnr		Tur		TSU	LHG
							ACQ		Gnr			ACQ	HS	
							TRK	Press		Plt		ACQ	HS	
						STBY TOW				Plt	Tur		HS	Cyc
						ARMED				Plt	Tur		HS	Cyc
	PILOT			OFF						Plt	Tur		HS	Cyc
	FIXED			OFF						Plt	Tur		Reflex	Cyc
				ORIDE					Gnr		Tur		HS	Cyc

ARMAMENT CONFIGURATION 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

PILOT SWITCHES				GUNNER SWITCHES					GUNNER	PILOT	CAN		USING	
MASTER ARM	WPN CONTR	WING STORE	ZONE ARM	PLT ORIDE	WING STORE	MODE SELECT	ACQ TRK STOW	PHS ACQ			FIRE	ACQ TGT FOR TSU	SIGHT	WPN TRIG ON
ARM	GUNNER	*RKT/GUN	ARMED	OFF		OFF			Gnr		Tur		HS	LHG
										Plt	Ws		Reflex	Cyc
						TSU/GUN	STOW		Gnr		Tur		HS	LHG
										Plt	Ws		Reflex	Cyc
							TRK		Gnr		Tur		TSU	LHG
										Plt	Ws		Reflex	Cyc
							ACQ		Gnr			ACQ	HS	
							TRK	Press		Plt		ACQ	HS	
						STBY TOW OR ARMED				Plt	Tur		HS	Cyc
											Ws		Reflex	Cyc
	PILOT	*RKT/GUN	ARMED	OFF						Plt	Tur		HS	Cyc
											Ws		Reflex	Cyc
	FIXED	*RKT/GUN	ARMED	OFF						Plt	Tur		Reflex	Cyc
											Ws		Reflex	Cyc
				ORIDE	*RKT GUN				Gnr		Tur		HS	Cyc
											Ws		None	Cyc

* RKT/GUN switch position will depend on wing stores load configuration.

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Figure 4.2-3. Armament Firing Modes (Sheet 1 of 2)

ARMAMENT CONFIGURATION 2, 3, 4, 5, 6, 7, 8, 9

PILOT SWITCHES				GUNNER SWITCHES					GUNNER	PILOT	CAN		USING	
MASTER ARM	WPN CONTR	WING STORE	ZONE ARM	PLT ORIDE	WING STORE	MODE SELECT	ACQ TRK STOW	PHS ACQ			FIRE	ACQ TGT FOR TSU	SIGHT	WPN TRIG ON
ARM	GUNNER	*RKT/ GUN	ARMED	OFF		OFF			Gnr		Tur		HS	LHG
										Plt	Inbd		Reflex	Cyc
						TSU/ GUN	STOW		Gnr		Tur		HS	LHG
										Plt	Inbd		Reflex	Cyc
							TRK		Gnr		Tur		TSU	LHG
										Plt	Inbd		Reflex	Cyc
							ACQ		Gnr			ACQ	HS	
							TRK	Press		Plt		ACQ	HS	
						STBY TOW	STOW			Plt	Tur		HS	Cyc
											Inbd		Reflex	Cyc
							TRK			Plt	Tur		HS	Cyc
											Inbd		Reflex	Cyc
							ACQ		Gnr			ACQ	HS	
							TRK	Press		Plt		ACQ	HS	
						ARMED	STOW			Plt	Tur		HS	Cyc
											Inbd		Reflex	Cyc
							TRK		Gnr		TOW		TSU	LHG
										Plt	Tur		HS	Cyc
											Inbd		Reflex	Cyc
							ACQ		Gnr			ACQ	HS	
							TRK	Press		Plt		ACQ	HS	
	PILOT	*RKT/ GUN	ARMED	OFF						Plt	Tur		HS	Cyc
											Inbd		Reflex	Cyc
	FIXED	*RKT/ GUN	ARMED	OFF						Plt	Tur		Reflex	Cyc
											Inbd		Reflex	Cyc
				ORIDE	*RKT/ GUN				Gnr		Tur		HS	Cyc
											Inbd		None	Cyc

* RKT/GUN switch position will depend on wing stores load configuration.

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Figure 4.2-3. Armament Firing Modes (Sheet 2 of 2)

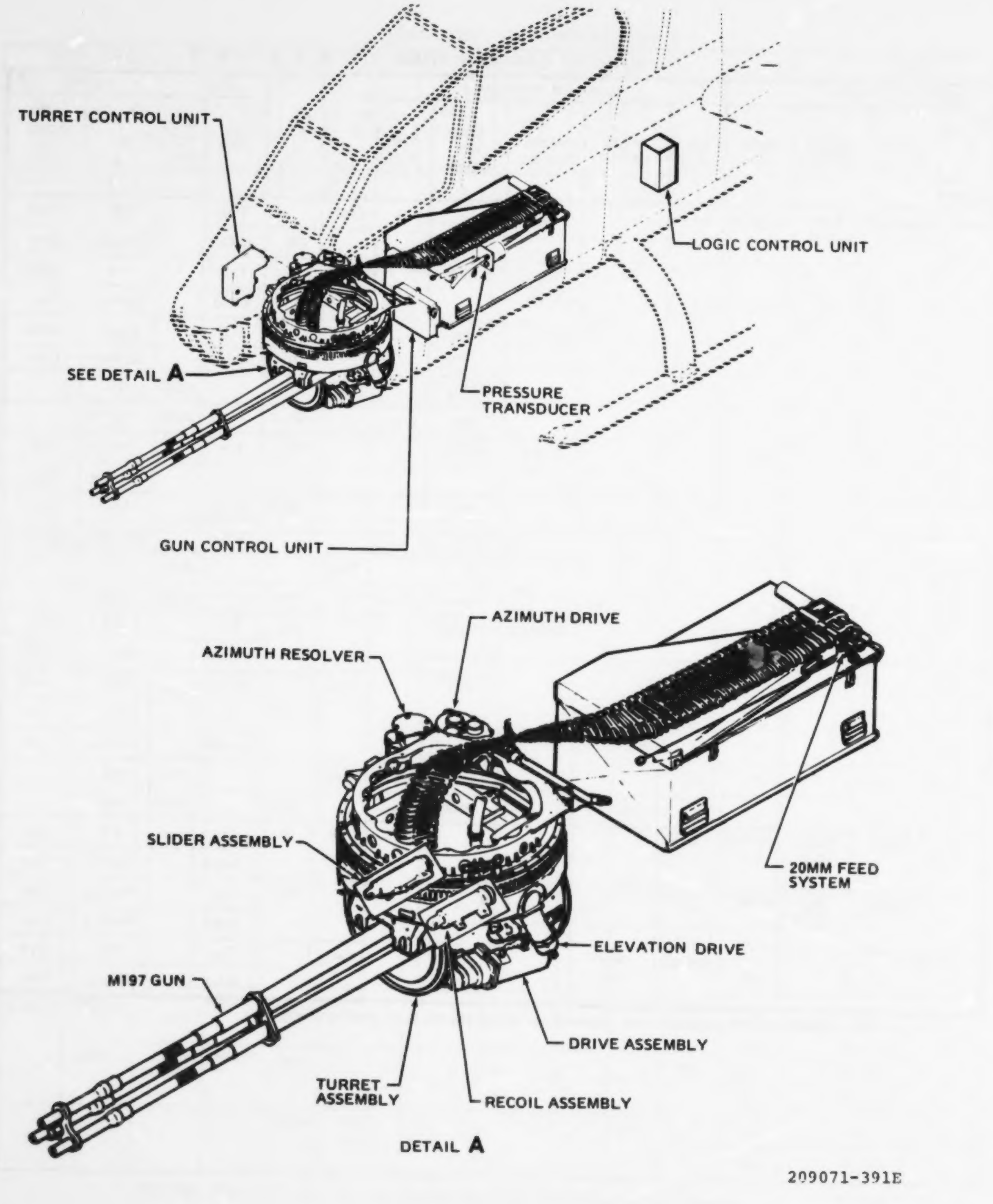
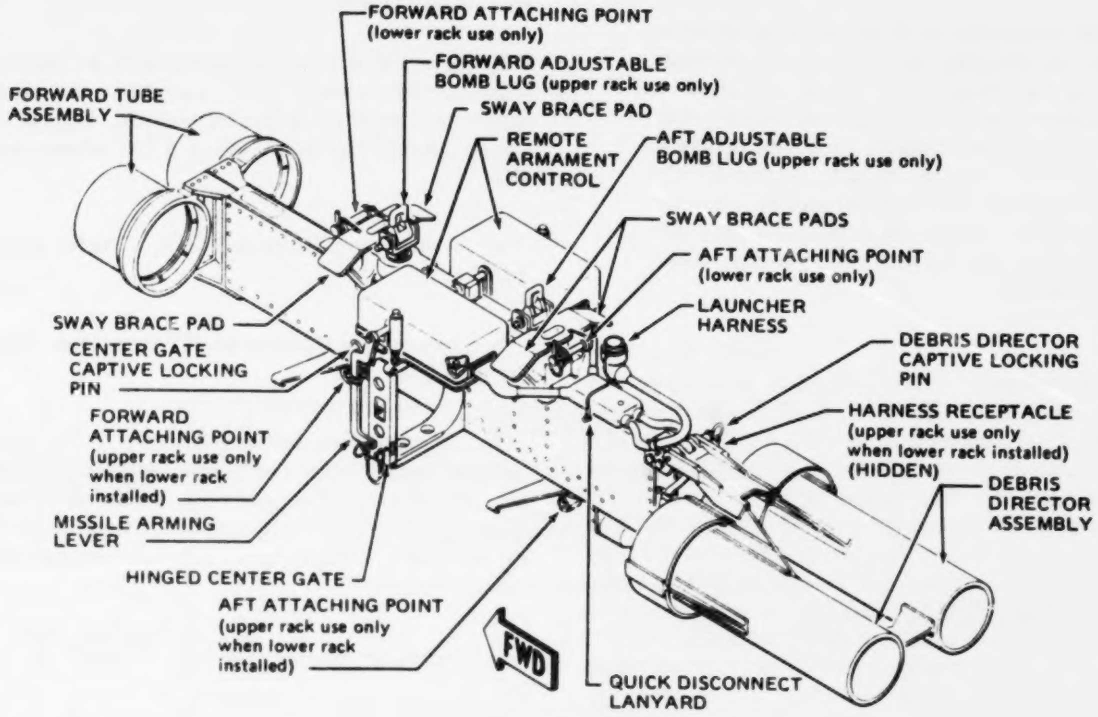
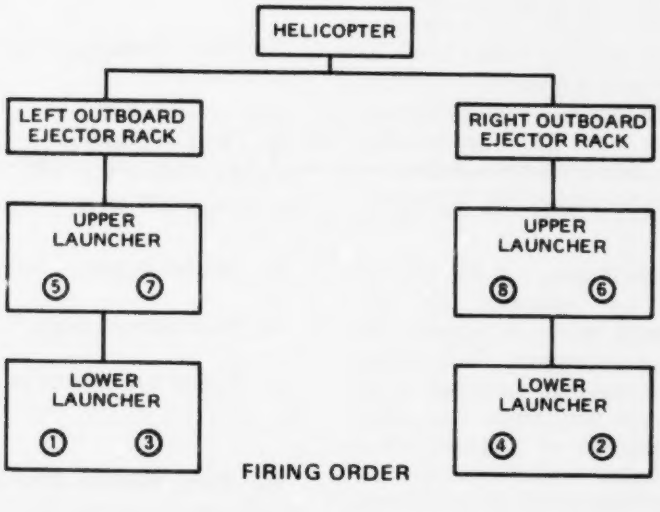

TURRET CONTROL UNIT
LOGIC CONTROL UNIT
SEE DETAIL A
PRESSURE TRANSDUCER
GUN CONTROL UNIT
AZIMUTH DRIVE
AZIMUTH RESOLVER
SLIDER ASSEMBLY
20MM FEED SYSTEM
ELEVATION DRIVE
M197 GUN
DRIVE ASSEMBLY
TURRET ASSEMBLY
RECOIL ASSEMBLY
DETAIL A
209071-391E

Figure 4.2-4. Universal Turret Components


FORWARD ATTACHING POINT (lower rack use only)
FORWARD ADJUSTABLE BOMB LUG (upper rack use only)
FORWARD TUBE ASSEMBLY
SWAY BRACE PAD
REMOTE ARMAMENT CONTROL
AFT ADJUSTABLE BOMB LUG (upper rack use only)
SWAY BRACE PADS
AFT ATTACHING POINT (lower rack use only)
LAUNCHER HARNESS
SWAY BRACE PAD
CENTER GATE CAPTIVE LOCKING PIN
DEBRIS DIRECTOR CAPTIVE LOCKING PIN
FORWARD ATTACHING POINT (upper rack use only when lower rack installed)
HARNESS RECEPTACLE (upper rack use only when lower rack installed) (HIDDEN)
DEBRIS DIRECTOR ASSEMBLY
MISSILE ARMING LEVER
HINGED CENTER GATE
AFT ATTACHING POINT (upper rack use only when lower rack installed)
FWD
QUICK DISCONNECT LANYARD

LAUNCHER


HELICOPTER
LEFT OUTBOARD EJECTOR RACK
RIGHT OUTBOARD EJECTOR RACK
UPPER LAUNCHER
⑤ ⑦
UPPER LAUNCHER
⑧ ⑥
LOWER LAUNCHER
① ③
LOWER LAUNCHER
④ ②

FIRING ORDER

209071-343A

Figure 4.2-5. TOW Missile Launcher

NOTE

The subsystem is designed to be effective during daylight conditions. Use at night may be effective if flares are used to augment visibility. Problems with glare on sight reticles, inability to adjust reticle in intensity during target tracking, and difficulty in acquiring targets at unknown locations during darkness, will degrade system performance during night operations.

c. **Rockets.** The Rocket Management Subsystem (RMS) (TM 9-1270-217-13) is a light antipersonnel assault weapon. The RMS consists of a Display Unit (figures 2-4 and 4.2-6) located in the pilot station and Operations Units located in the leading edge of the wings, one for each of the four wing stores racks. The Display Unit permits the pilot to select the desired type of 2.75 inch folding fin aerial rocket (FFAR) warhead, fuze quantity, range, and rate. Seven or nineteen tube launchers (figure 4.2-7) can be mounted on each of the inboard and outboard wing stores racks. The rocket launchers are divided into zones as shown in figure 4.2-7.

d. **Wing Gun Pod.** The pod (figure 4.2-8) (TM 9-1005-257-12) is a self-contained unit housing a 7.62 mm machine gun, its own electrical system, a battery recharging system, and a maximum of 1500 rounds of ammunition. The gun is capable of firing 2000 or 4000 (M18A1) or 4000 (M18) rounds per minute. The pod configuration can be detected by the firing rate and heater switches on the rear of the pod.

e. **Wing Stores Jettison (Figure 4.2-9).** Each of the four ejector racks are equipped with an electrically operated ballistic device to jettison the attached weapon during an emergency. Each device has two cartridges. The second cartridge fires automatic if the first fails to fire. When four TOW missile launchers are installed on outboard wing stations the TOW missile launchers will jettison prior to the inboard stores regardless of the jettison select switches position.

f. **Helmet Sight Subsystem (HSS).** The HSS (figure 4.2-10) (TM 9-1270-212-14) permits the pilot or gunner to rapidly acquire visible targets and to direct the turret and/or the telescopic sight unit (TSU) to those targets.

4.2-6. PILOT SWITCHES AND INDICATORS.

Pilot panels and switches are interfaced with other pilot/gunner panels and switches for weapon operations and wing stores jettison. Figure 4.2-2 shows panel interface. Figure 4.2-3 shows switch interface.

a. **Armament Control Panel.** Refer to figure 4.2-11.

b. **Integrated Control and Display Unit.** Refer to figure 4.2-6.

c. **Wing Stores Jettison Switch.** The guarded jettison switch is on the pilot collective stick switch box. Activation of the switch will jettison the weapons from the inboard, outboard, or all four of the wing ejector racks. Refer to figure 4.2-9 for various jettison combinations.

d. **Jettison Select Switch.** Refer to figure 4.2-9.

e. **Armament Circuit Breakers.** Refer to figure 4.2-12.

f. **Pilot Steering Indicator (PSI).** Refer to figure 4.2-13.

g. **Pilot Gunner Accuracy Control Panel (GACP) (Figure 4.2-14).** Provisions are provided for panel installation.

h. **Reflex Sight.** Refer to figure 4.2-15.

i. **Pilot Helmet Sight.** Refer to figure 4.2-10.

j. **Cyclic Armament Switches.** Refer to figure 2-4.

k. **Pilot Missile Status Indicator (MSI).** The missile status indicator (figure 2-6) displays either an L, R, or barber pole indication. An L indicates the gunner has selected a TOW misile to be launched from a launcher mounted on the left side of the helicopter, an R indicates the gunner has selected a TOW missile to be launched from a launcher mounted on the right side of the helicopter, and a barber pole indicates no missile has been selected.

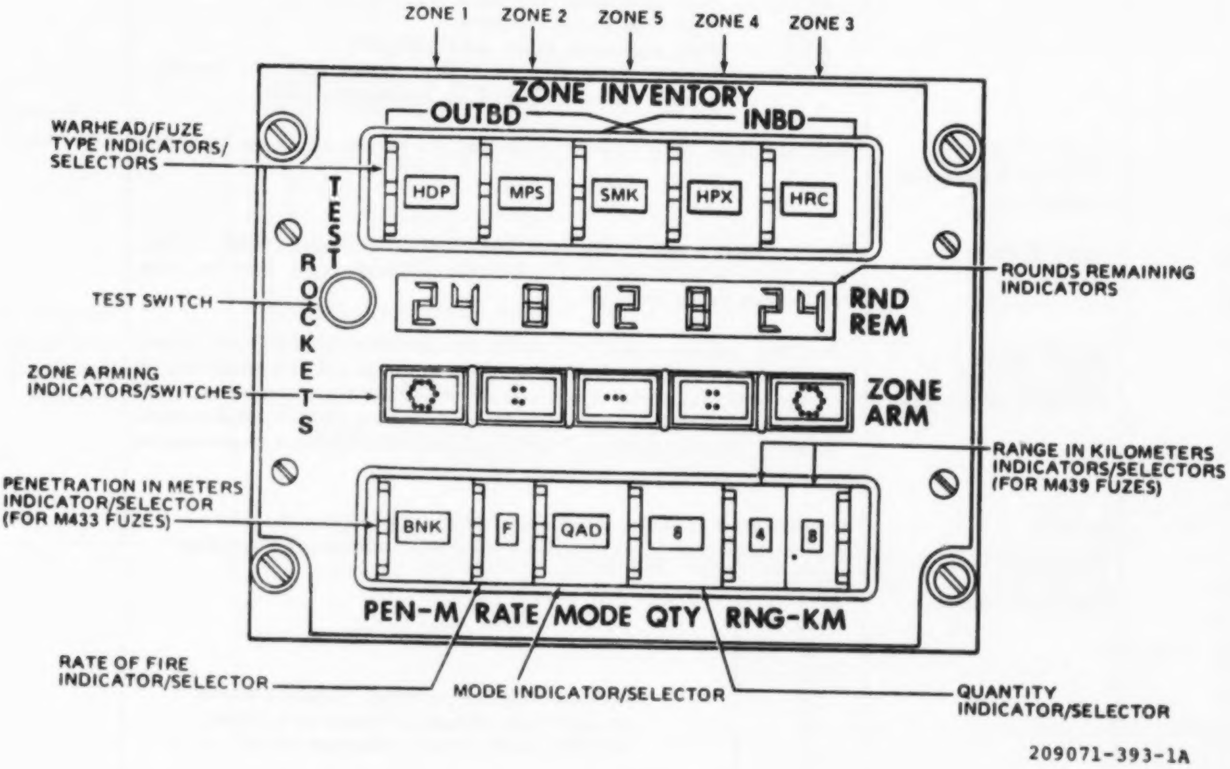

ZONE 1
ZONE 2
ZONE 5
ZONE 4
ZONE 3
ZONE INVENTORY
OUTBD
INBD
WARHEAD/FUZE TYPE INDICATORS/ SELECTORS
HDP
MPS
SMK
HPX
HRC
TEST
ROCKETS
ROUNDS REMAINING INDICATORS
TEST SWITCH
24 8 12 8 24
RND REM
ZONE ARMING INDICATORS/SWITCHES
ZONE ARM
RANGE IN KILOMETERS INDICATORS/SELECTORS (FOR M439 FUZES)
PENETRATION IN METERS INDICATOR/SELECTOR (FOR M433 FUZES)
BNK
F
QAD
8
4
8
PEN-M
RATE
MODE
QTY
RNG-KM
RATE OF FIRE INDICATOR/SELECTOR
MODE INDICATOR/SELECTOR
QUANTITY INDICATOR/SELECTOR
209071-393-1A

Figure 4.2-6. Rocket Management System Display Unit (Sheet 1 of 3)

SELECTOR	FUNCTION
ZONE INVENTORY (Warhead/Fuze Type) Indicators/Selectors	Indicates type of round loaded in zone. CHF — Chaff warhead (countermeasures). MPS — Multi-purpose submunition/resistance capacitance. SMK — Smoke screen/resistance capacitance. ILM — Illumination/resistance capacitance. FLC — Flechette — submunition/resistance capacitance. H17 — 17 pound, high explosive, point detonating or proximity. WP — White phosphorous/point detonating. HDP — High explosive/dual purpose. HRC — High explosive/resistance capacitance. HPX — High explosive/proximity. HPD — High explosive/point detonating. Blank — Special purpose, i.e. inert, target XM — marker, guided rocket, future E.W. countermeasure.
RND REM (Rounds Remaining Indicators)	Indicates functional rounds remaining in inventory by zone location.
TEST Switch	Tests digital display segment and indicator lamps (RND REM), and subsystem (including helicopter wiring) from end to end (excluding firing circuits).
ZONE ARM (Zone Arming) Indicator/Switches	Pressing appropriate ZONE ARM switch arms selected zone. When any one zone is selected (armed) all other zones with identical rounds are automatically armed and visually indicated by appropriate ZONE ARM switch(es). Any round selected by pressing a ZONE ARM switch, which is different (different zone) will automatically de-arm previously selected zone(s).
PEN-M (Penetration In Meters) Indicator/Selector	Permits pilot to select tree height range detonation (in five meter increments), superquick detonation or bunker penetration detonation. 45 — 40 — 35 — 30 — 25 — 20 — 15 — 10 — Canopy height in meters. Enables round to penetrate canopy of forest or building and detonate at more effective point. BNK — Bunker penetration — to defeat bunkers (logs and dirt) up to 3 meters thick. SQ — Superquick — detonates when fuze makes contact with any object.

209071-393-2A

Figure 4.2-6. Rocket Management System Display Unit (Sheet 2 of 3)

SELECTOR	FUNCTION
RATE Indicator/Selector	F — Fast, fires rockets at 60 plus or minus 6 millisecond intervals. S — Slow, fires rockets at 180 plus or minus 18 millisecond intervals. A — Automatic, enables system to set firing interval from predetermined rates that would be programmed for each type of rocket/fuze combination that is available for selection.
MODE Indicator/Selector	QAD — Quad fire of four rounds, one from each launcher with inboard rounds leading outboard rounds by 30 milliseconds. PRS — Pair firing of two rounds, one from each side of helicopter from zone that has been armed. SNG — Single fire of one round, alternating from side to side of helicopter.
QTY (Quantity) Indicator/Selector	Selects quantity of rockets to be fired and are a multiple of the MODE indicator/selector setting. ALL — Sustained or continuous fire of all rounds selected. 8 — 8 x MODE setting of rounds selected. 4 — 4 x MODE setting of rounds selected. 2 — 2 x MODE setting of rounds selected. 1 — 1 x MODE setting of rounds selected.
RNG—KM (Range In Kilometers) Indicators/Selectors	Selects range of M439 fuze from 500 to 6000 meters in 100 meter increments. Left Indicator/Selector: Numerals — Selects 1000 meter position. A — Provides automatic range selection with time to function data from fire control computer. Right Indicator/Selector: Numerals—Selects 100 meter position. Any ranges selected less than 500 meters (0.5) will only provide 500 meter range settings.

209071-393-3A

Figure 4.2-6. Rocket Management System Display Unit (Sheet 3 of 3)

All data on page 4.2-12 is deleted.

LAUNCHER ZONING

ZONE 1 — Outer ring of 19 tube launcher when installed on outboard wing stores rack for a total of 24 rockets.

ZONE 2 — Two top and two bottom tubes of the inner ring of 19 tube launcher or two top and two bottom tubes of the outer ring of 7 tube launcher, when installed on outboard wing stores rack for a total of 8 rockets.

ZONE 3 — Outer ring of 19 tube launcher when installed on inboard wing stores rack for a total of 24 rockets.

ZONE 4 — Two top and two bottom tubes of the inner ring of 19 tube launcher or two top and two bottom tubes of the outer ring of 7 tube launcher, when installed on inboard wing stores rack for a total of 8 rockets.

ZONE 5 — Center three tubes of 19 tube and 7 tube launchers for a total of 12 rockets.

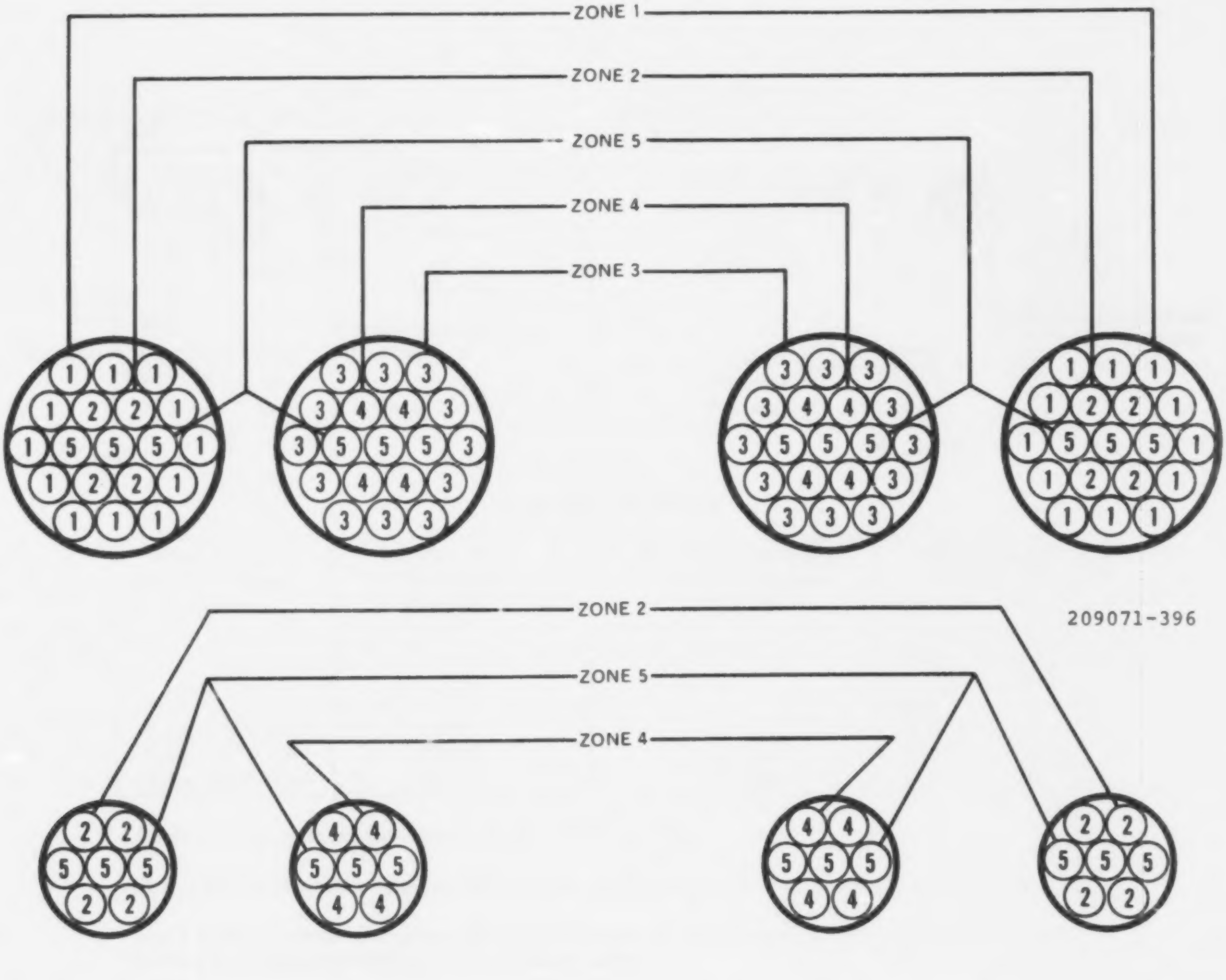


Figure 4.2-7. Folding Fin Aerial Rocket (2.75 Inch) Launcher

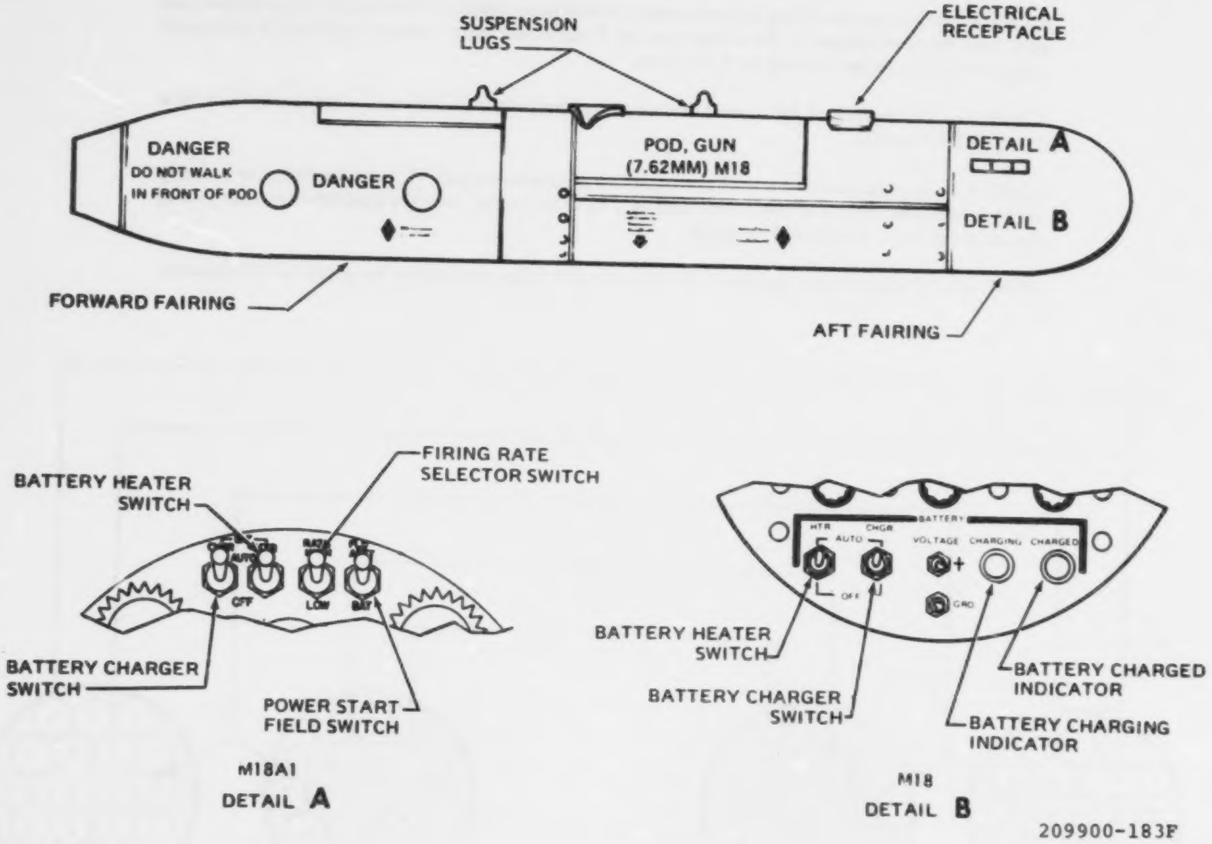
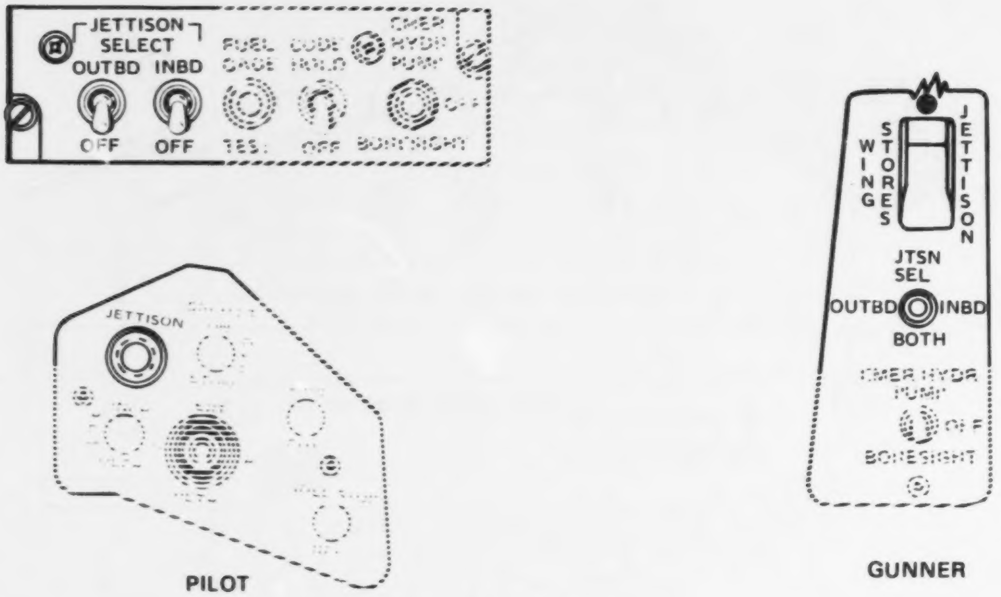

SUSPENSION LUGS
ELECTRICAL RECEPTACLE
DANGER
DO NOT WALK IN FRONT OF POD
DANGER
POD, GUN (7.62MM) M18
DETAIL A
DETAIL B
FORWARD FAIRING
AFT FAIRING
FIRING RATE SELECTOR SWITCH
BATTERY HEATER SWITCH
AUTO
OFF
LOW
BAT
BATTERY CHARGER SWITCH
POWER START FIELD SWITCH
M18A1
DETAIL A
BATTERY
HTR
CHGR
AUTO
OFF
VOLTAGE
+
GRD
CHARGING
CHARGED
BATTERY HEATER SWITCH
BATTERY CHARGER SWITCH
BATTERY CHARGED INDICATOR
BATTERY CHARGING INDICATOR
M18
DETAIL B
209900-183F

Figure 4.2-8. Wing Gun Pod


JETTISON SELECT
OUTBD
INBD
OFF
OFF
FUEL GAGE
CODE HOLD
EMER HYDR PUMP
TEST
OFF
BORESIGHT
JETTISON
WING STORES JETTISON
JTSN SEL
OUTBD
INBD
BOTH
EMER HYDR PUMP
OFF
BORESIGHT

PILOT

GUNNER

PILOT JETTISON

PLT JETT Circuit Breaker Position	Pilot JETTISON SELECT Switch Position	Pilot Jettison Switch Position	Wing Stores Jettisoned	
			2 TOW	4 TOW
OFF	*	*	None	None
PLT JETT (On)	Inbd	Pressed	Inbd	Both
PLT JETT (On)	Outbd	Pressed	Outbd	Outbd
PLT JETT (On)	Inbd/Outbd	Pressed	Both	Both

GUNNER JETTISON

GNR JETT Circuit Breaker Position	Gunner JTSN SEL Switch Position	Gunner Wing Stores Jettison Switch Position	Wing Stores Jettisoned	
			2 TOW	4 TOW
OFF	*	*	None	None
GNR JETT (On)	Inbd	Up (On)	Inbd	Both
GNR JETT (On)	Outbd	Up (On)	Outbd	Outbd
GNR JETT (On)	Both	Up (On)	Both	Both

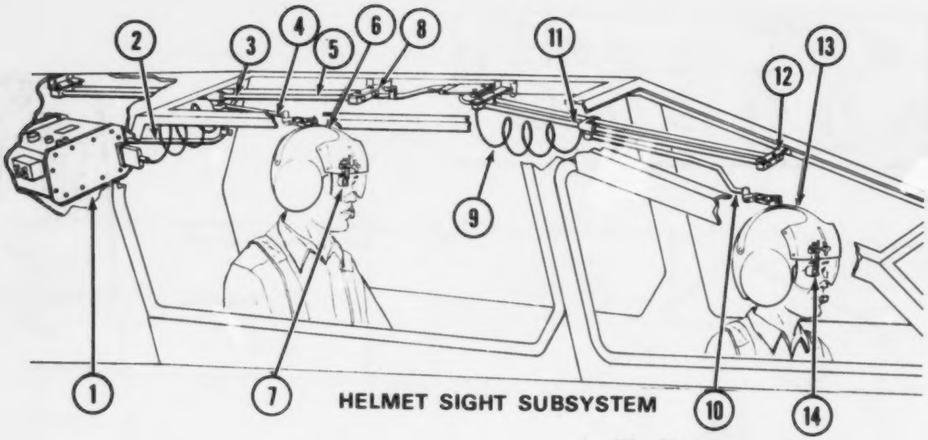
*Switch position makes no difference.

In the BOTH jettison sequence the outboard stores leave first followed by the inboard.

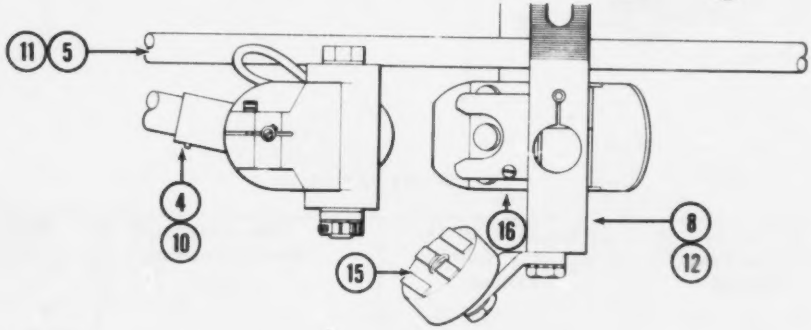
The electrical circuit interface will allow jettison of the inboard stores if only two missile launch tubes are installed on the outboard racks.

209075-409

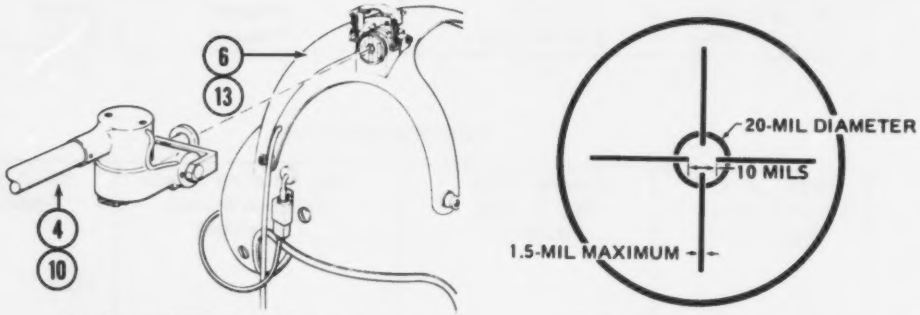
Figure 4.2-9. Wing Stores Jettison


2
3
4
5
6
8
11
13
12
9
1
7
10
14

HELMET SIGHT SUBSYSTEM


11
5
4
10
16
8
12
15

PILOT/GUNNER LINKAGE ARM ATTACHMENT TO BIT MAGNET AND STOW BRACKET


6
13
4
10
20-MIL DIAMETER
10 MILS
1.5-MIL MAXIMUM

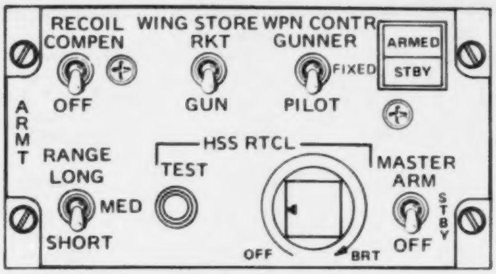
PILOT/GUNNER LINKAGE ARM ATTACHMENT TO HELMET SIGHT

PILOT/GUNNER EYEPIECE RETICLE PATTERN

209071-344A

1. Electronic interface assembly
2. Gunner extension cable
3. Pilot linkage cable
4. Pilot linkage arm
5. Pilot linkage rails
6. Pilot helmet sight
7. Pilot eyepiece
8. Pilot linkage front support
9. Gunner linkage cable
10. Gunner linkage arm
11. Gunner linkage rails
12. Gunner linkage front support
13. Gunner helmet sight
14. Gunner eyepiece
15. BIT magnet
16. Stow bracket

Figure 4.2-10. Helmet Sight Subsystem (HSS)

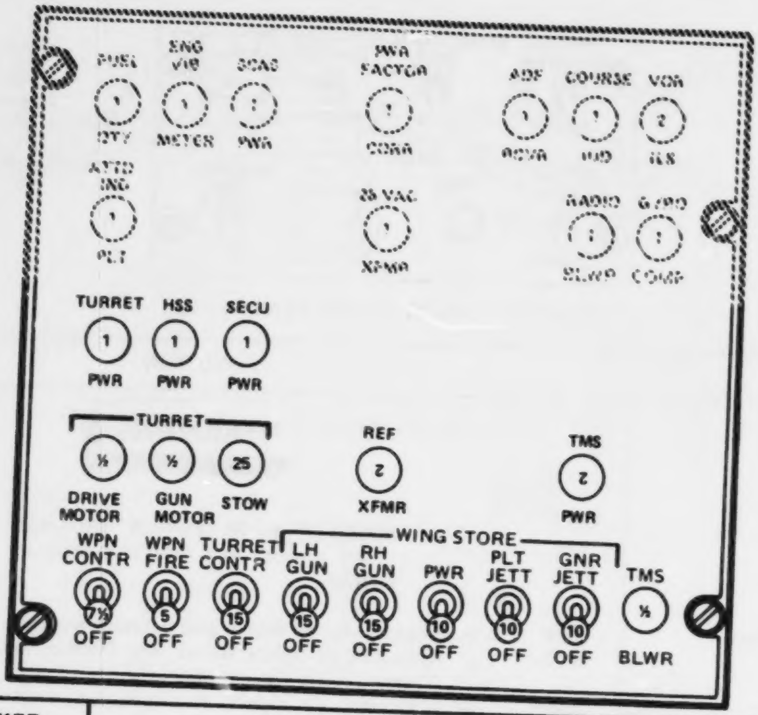


LOCATION: PILOT INSTRUMENT PANEL

ITEM	FUNCTION
	WARNING MASTER ARM switch bypassed when gunner PLT ORIDE switch in ORIDE.
MASTER ARM Switch	OFF — Deactivates all sights and weapon control/firing circuits. STBY — Activates all sights, turret, and TOW missile control circuits. Charges wing gun pod battery. ARM — Activates all sights and weapon control/firing circuits. Charges wing gun pod battery.
WPN CONTR Switch	PILOT — Permits pilot to fire turret using HS and wing stores (not TOW) using reflex sight. Illuminates gunner PILOT IN CONT light. FIXED — Permits pilot to fire turret and wing stores (not TOW) using reflex sight. GUNNER — Permits gunner to fire turret using helmet sight or TSU and TOW using TSU.
HSS RTCL OFF/BRT Switch	OFF — Deactivates pilot HS reticle lamps. Rotate — Varies intensity of pilot HS reticle lamps.
HSS RTCL TEST Switch	TEST — Tests pilot HS reticle. (No reticle if one light element of HSS is burned out.)
ARMED/STBY Indicator	ARMED — Indicates MASTER ARM switch in ARM or gunner PLT ORIDE switch in PLT ORIDE (amber light). STBY — Indicates MASTER ARM switch in STBY (green light). OFF — Indicates MASTER ARM switch is off. Press — Tests indicator lights.
WING STORE Switch	RKT — Permits pilot or gunner to fire rockets. GUN — Permits pilot or gunner to fire wing mounted gun.
RECOIL Switch	OFF — Deactivates turret recoil compensation. COMPEN — Applies input to SCAS to compensate for turret recoil.
RANGE Switch	LONG/ MED/ SHORT — Provides range to target data to compensation circuit.

209075-397C

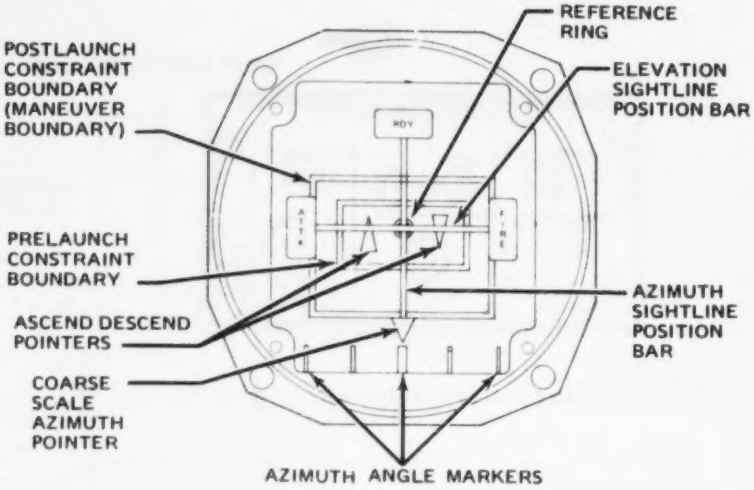
Figure 4.2-11. Pilot Armament Control Panel


FUEL
1
QTY
ENG VIB
1
METER
SCAS
1
PWR
PWR FACTOR
1
CORR
ADF
1
RCVR
COURSE
1
IND
VOR
2
ILS
ATTD IND
1
PLT
26 VAC
1
XFMR
RADIO
1
BLWR
GYRO
1
COMP
TURRET
1
PWR
HSS
1
PWR
SECU
1
PWR
TURRET
½
DRIVE MOTOR
½
GUN MOTOR
25
STOW
REF
2
XFMR
TMS
2
PWR
WING STORE
WPN CONTR
7½
OFF
WPN FIRE
5
OFF
TURRET CONTR
15
OFF
LH GUN
15
OFF
RH GUN
15
OFF
PWR
10
OFF
PLT JETT
10
OFF
GNR JETT
10
OFF
TMS
½
BLWR

CIRCUIT BREAKER	FUNCTION — Applies Power to and Protects Circuit for
TURRET PWR	Turret power.
HSS PWR	Helmet sight subsystem power.
SECU PWR	Servo electronic control unit power.
TURRET	
DRIVE MOTOR	Turret drive motor.
GUN MOTOR	Turret gun motor.
STOW	Turret stow control.
REF XFMR	Reference transformer.
TMS PWR	TOW missile system power.
WPN CONTR	Master arm switch standby power.
WPN FIRE	Master arm switch fire power.
TURRET CONTR	Gun control assembly.
WING STORE	
LH GUN	Left inboard wing gun pod firing.
RH GUN	Right inboard wing gun pad firing.
PWR	Left/right inboard/outboard rocket firing.
PLT JETT	Wing store jettison — pilot.
GNR JETT	Wing store jettison — gunner.
TMS BLWR	TOW missile system blower.

209075-399B

Figure 4.2-12. Pilot Armament Circuit Breakers

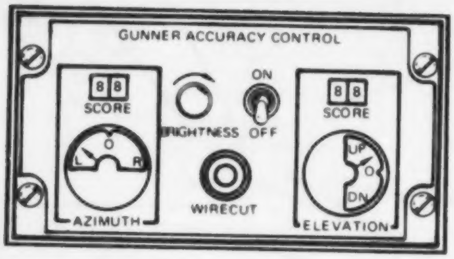

REFERENCE RING
POSTLAUNCH CONSTRAINT BOUNDARY (MANEUVER BOUNDARY)
ELEVATION SIGHTLINE POSITION BAR
RDY
ATTK
FIRE
PRELAUNCH CONSTRAINT BOUNDARY
AZIMUTH SIGHTLINE POSITION BAR
ASCEND DESCEND POINTERS
COARSE SCALE AZIMUTH POINTER
AZIMUTH ANGLE MARKERS

LOCATION: TOP OF PILOT INSTRUMENT PANEL

ITEM	FUNCTION
ATTK Annunciator	ON — Indicates TCP MODE SELECT switch is in ARMED position. All requirements for firing have been met, except pre-launch constraint.
RDY Annunciator	ON — Indicates pilot has achieved prelaunch constraints.
FIRE Annunciator	ON — Indicates trigger has been pulled and firing sequence started.
Reference Ring (Fixed)	— Represents helicopter reference axis.
Prelaunch Constraint Boundary (Fixed)	— Represents boundary within which the pilot must keep the sightline position bars prior to and during TOW launch. The boundary represents ± 2.5° aximuth and ± 6° elevation.
Postlaunch Constraint Boundary (Fixed)	— Represents boundary within which the pilot must keep the sightline position bars after TOW launch and until wire cut or missile impact.
Elevation/ Azimuth Sightline Position Bars (Moveable)	— Indicate elevation and azimuth of TSU gimbal angles with respect to helicopter reference axis (reference ring) and constraint boundaries.
Ascend Descend Pointers (Indicator)	ON — Indicates helicopter requires a nose-up or nose-down attitude to reduce the line-of-sight rate during prelaunch stage. OFF — Indicates helicopter nose-up and nose-down attitudes and line-of-sight rate are compatible.
Azimuth Angle Markers (Fixed)	— Represents TSU ± 110° azimuth limits.
Coarse Scale Azimuth Pointer (Moveable)	— Indicates azimuth of TSU gimbal angles on the azimuth angle markers.

209071-345E

Figure 4.2-13. Pilot Steering Indicators (PSI)

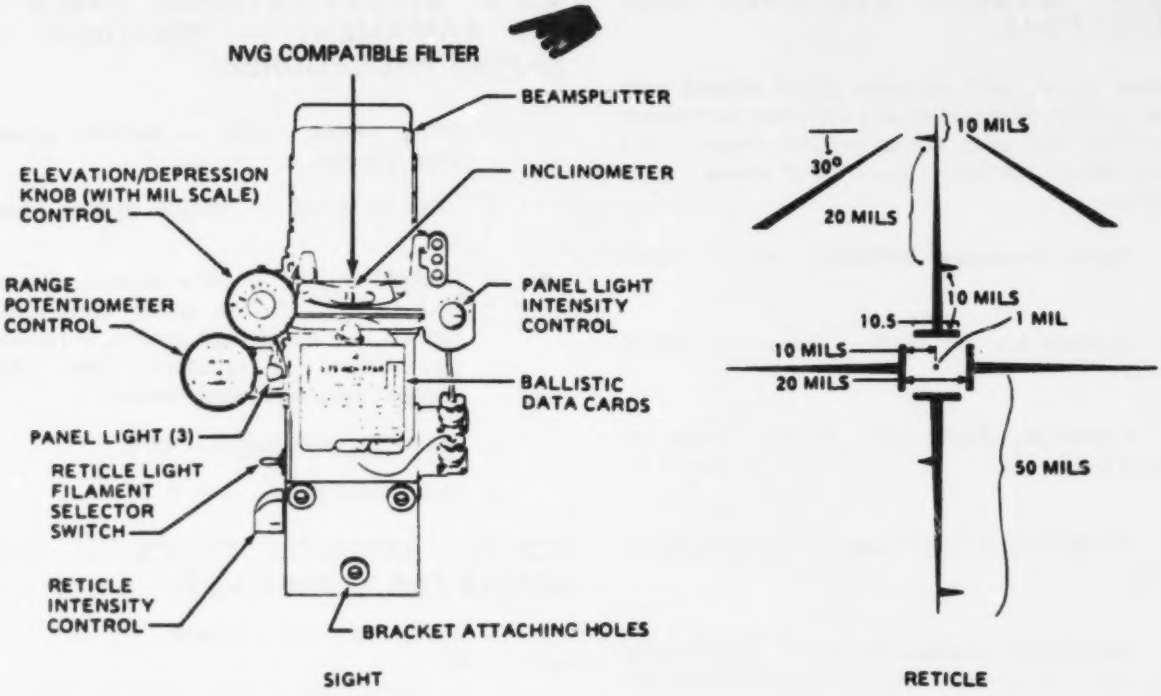

GUNNER ACCURACY CONTROL
88
SCORE
L
O
R
AZIMUTH
BRIGHTNESS
ON
OFF
WIRECUT
88
SCORE
UP
O
DN
ELEVATION

LOCATION: PILOT INSTRUMENT PANEL IF INSTALLED

ITEM	FUNCTION
ON/OFF Switch	**ON — Activates gunner accuracy control circuits.** **— Performs built-in-test of circuits. Circuits pass test if AZIMUTH/ELEVATION SCORE indicators display 55 ± 5.** **OFF — Deactivates circuits.**
WIRE CUT Switch	**Press — Resets indicators and deactivates camera.**
AZIMUTH Indicator	**— Displays TSU azimuth line-of-sight.**
AZIMUTH SCORE Indicator	**— Displays gunner final azimuth score.**
ELEVATION Indicator	**— Displays TSU elevation line-of-sight.**
ELEVATION SCORE Indicator	**— Displays gunner final elevation score.**
BRIGHTNESS Knob	**Turn — Varies intensity of AZIMUTH/ELEVATION SCORE indicator lights.**

209071-347B

Figure 4.2-14. Gunner Accuracy Control Panel (GACP)


NVG COMPATIBLE FILTER
BEAMSPLITTER
ELEVATION/DEPRESSION KNOB (WITH MIL SCALE) CONTROL
INCLINOMETER
RANGE POTENTIOMETER CONTROL
PANEL LIGHT INTENSITY CONTROL
BALLISTIC DATA CARDS
PANEL LIGHT (3)
RETICLE LIGHT FILAMENT SELECTOR SWITCH
RETICLE INTENSITY CONTROL
BRACKET ATTACHING HOLES
SIGHT
10 MILS
30°
20 MILS
10 MILS
10.5
1 MIL
10 MILS
20 MILS
50 MILS
RETICLE

LOCATION: TOP OF PILOT INSTRUMENT PANEL

ITEM	FUNCTION
Elevation/Depression Control	Varies angle of beamsplitter to adjust for range and airspeed when firing wing stores (not TOW) per the ballistic data cards.
Range Potentiometer Control	Not used.
Reticle Intensity Control	Adjust intensity of reticle lights.
Reticle Light Filament Selector Switch	Selects one of two filaments of reticle light.
Panel Light Intensity Control	Adjust intensity of panel lights.
Inclinometer	Indicates helicopter yaw attitude.

209071-397A

Figure 4.2-15. Pilot Reflex Sight (Typical)

4.2-7. GUNNER SWITCHES AND INDICATORS.

Gunner panels and switches are interfaced with other gunner/pilot panels and switches for weapon operations and wing stores jettison. Figure 4.2-2 shows panel interface. Figure 4.2-3 shows switch interface.

a. **Cyclic Armament Switches.** Refer to figure 2-13.

b. **Gunner Helmet Sight.** Refer to figure 4.2-10.

c. **Telescopic Sight Unit (TSU).** Refer to figure 4.2-16.

d. **Armament Control Panel.** Refer to figure 4.2-17.

e. **Wing Stores Jettison Switch.** The guarded switch is on the gunner instrument panel. Activation of the switch will jettison weapons from ejector racks as selected by the JTSN SEL switch. The switch is powered and protected by the jettison circuit breakers in the electrical compartment. Refer to figure 4.2-9 for various jettison combinations.

f. **JTSN SEL Switch.** Refer to figure 4.2-9.

g. **Sight Hand Control (SHC).** Refer to figure 4.2-18.

h. **TOW Control Panel (TCP).** Refer to figure 4.2-19.

4.2-8. PREFLIGHT PROCEDURES.

WARNING

Do not rotate wing gun pod barrels. The machine gun will fire when rotated.

NOTE

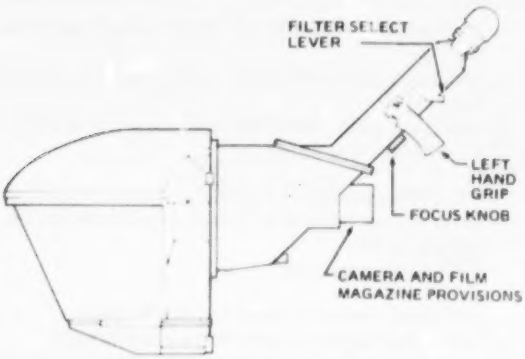
Checks herein are only applicable if the armament is installed and are in addition to those listed in Chapter 8. Chapter 4 does not duplicate Chapter 8 checks except for safety.

4.2-9. BEFORE EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT — SAFING PROCEDURES.

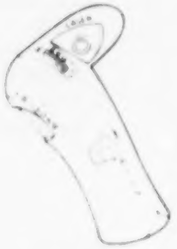
1. Wing ejector racks — Jettison safety pins installed.
2. TOW launcher — Missile arming lever up.
3. Rocket launcher — Igniter arms in contact with rockets. Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from EMI (electro-magnetic interference).
4. MASTER ARM switch — OFF.
5. PLT ORIDE switch — OFF.

4.2-10. EXTERIOR CHECK — ALL ARMAMENT — PREFLIGHT.

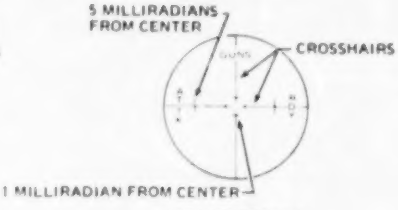
1. Turret right side — Check.
    a. Barrel clamp and retaining bolt — Secure.
    b. Gun mounting — Quick-release pins (ring up) installed through gun saddle holes and slider assembly, slider assembly secure on gun.
    c. Ammunition chute — Check condition and security.
    d. Feeder assembly — Check condition and security.
    e. Gun timing pin — Set.
    f. Feeder assembly timing pin — Set.
    g. Cartridge ejection chute — Check condition and security.
    h. Link ejection chute — Check condition and security.
    i. Firing lead — Check.
    j. Turret electrical leads — Check condition and security.
    k. Gun drive — Check condition of shear pins, check electrical connectors connected.



TELESCOPIC SIGHT UNIT LOCATION GUNNER STATION

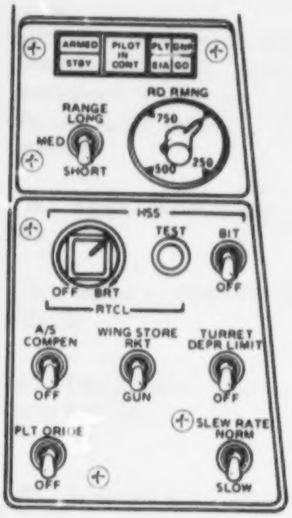


LEFT HAND GRIP



VIEW OF RETICLE

ITEM	FUNCTION
Left hand grip switches MAG switch	LO — Magnifies target two times. HI — Magnifies target 13 times.
TRIGGER switch	— Fires TOW if selected in first or second detent. — Fires turret if selected in First Detent — Limited to 16 round burst. Second Detent — Continuous burst.
ACTION switch	— Activates TOW launchers. — Slaves turret to TSU or gunner helmet sight.
LASER switch	— Inoperative.
TSU Reticle GUNS indicator	— When flashing, indicates TCP MODE SELECT switch is in TSU/GUN position and turret not aligned with TSU. — When steady, indicates TCP MODE SELECT switch is in TSU/GUN position and turret is aligned with TSU.
ATTK indicator	— Indicates TCP MODE SELECT switch is in ARMED position.
RDY indicator	— Indicates pilot has achieved prelaunch constraints for TOW firing.
Filter select lever	— Selects filters of different light intensities. Red: Use when firing a TOW missile to reduce glare from the IR source on the missile and thus allow proper tracking of the target. Clear: To be used during low light level conditions, such as hazy (smoke, fog, dust) days or under twilight conditions. Neutral Density: To be used on bright clear days or to reduce the glare reflected from bodies of water. Laser Filter: To be used during any laser ranging operations to protect the eyes from laser radiation energy.
Focus knob	— Focus the target image.



LOCATION: GUNNER RIGHT CONSOLE

ITEM	FUNCTION	
ARMED/ STBY Indicator	ARMED	— Indicates pilot MASTER ARM switch in ARM (red light).
	STBY	— Indicates pilot MASTER ARM switch in STBY (green light).
	Off	— Indicates pilot MASTER ARM switch is OFF.
	Press	— Tests indicator lights.
PILOT IN CONT Indicator	ON	— Pilot has control of turret.
	OFF	— Gunner has control of turret or pilot MASTER ARM switch is OFF.
	Press	— Tests indicator light.
PLT/ GNR/ EIA/ GO Indicators	PLT	— Indicates failure in pilot helmet linkage.
	GNR	— Indicates failure in gunner helmet linkage.
	EIA	— Indicates failure in electronic interface assembly.
	GO	— Indicates HSS operating properly.
	Press	— Tests indicator lights.
	Off	— Indicates HSS built-in-test not being conducted.
RANGE Switch	SHORT/ MED/ LONG	— Provides target range data to compensation circuit.
RD RMNG Counter	Gradations	— Indicates quantity of ammunition remaining for turret weapon.

ITEM	FUNCTION	
HSS RETICLE OFF/BRT Switch	OFF	— Deactivates gunner HSS reticle lights. Varies intensity of gunner HSS reticle lights when turned.
HSS RTCL TEST Switch	TEST	— Tests gunner HSS reticle.
HSS BIT Switch	OFF	— Deactivates pilot and gunner HSS built-in test circuit.
	BIT	— Tests pilot and gunner HSS when linkage arms attached to BIT magnets.
A/S COMPEN Switch	OFF	— Deactivates turret positioning circuits.
	COMPEN	— Applies airspeed/range data to turret positioning circuits.
WING STORE Switch	RKT	— Permits gunner to fire rockets.
	GUN	— Permits gunner to fire wing mounted gun.

ITEM	FUNCTION	
TURRET DEPR LIMIT Switch	OFF	— Permits turret travel between minimum to maximum elevation.
	DEPR LIMIT	— Limits downward travel to prevent turret weapon from striking ground.
PLT ORIDE Switch	OFF	— Permits pilot armament control panel to control the weapons.
	PLT ORIDE	— Overrides pilot armament control panel. Permits gunner to fire turret using HSS, and wing stores (not TOW) without sight.
SLEW RATE Switch	NORM	— Drives turret azimuth and elevation at 60 degrees per second.
	SLOW	— Drives turret azimuth and elevation at 4 to 8 degrees per second (used for ground operations servicing only).

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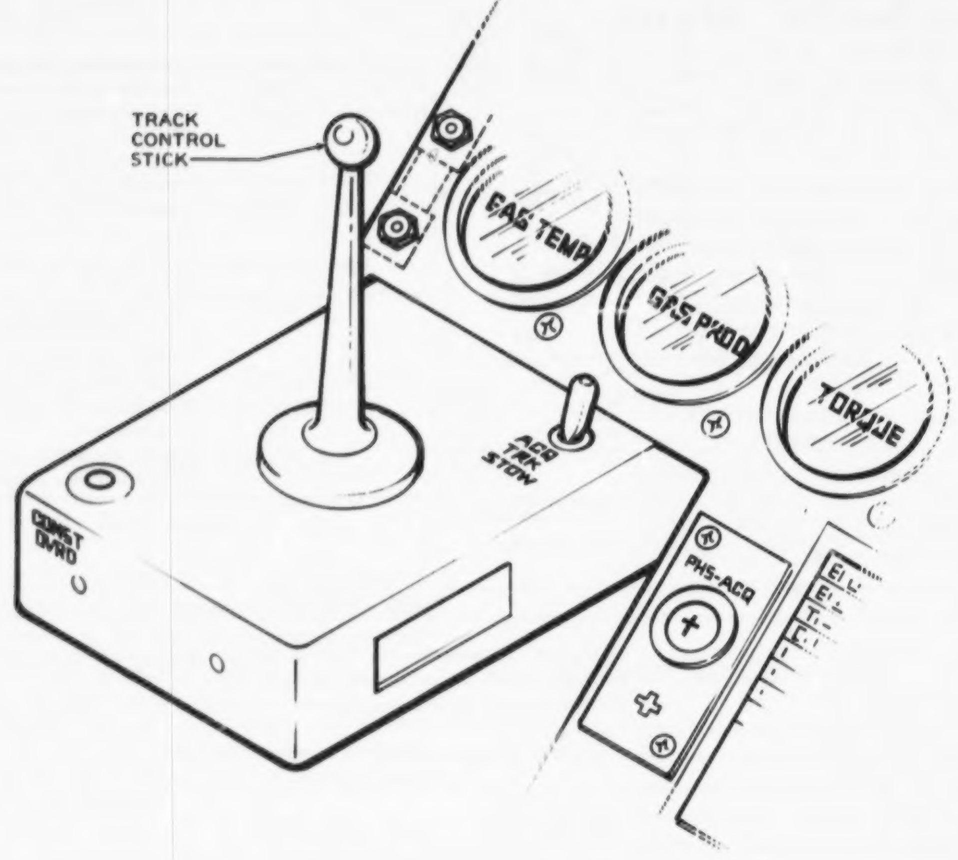
Figure 4.2-17. Gunner Armament Control Panel


TRACK CONTROL STICK
GAS TEMP
GAS PROD
TORQUE
ACQ
TRK
STOW
CONST OVRD
PHS-ACQ

LOCATION: GUNNER INSTRUMENT PANEL

ITEM	FUNCTION
Track Control Stick	Positions TSU in azimuth and elevation.
ACQ/TRK/STOW Switch	ACQ — Slaves TSU to gunner HS for target acquisition. TRK — Permits track control handle to position TSU. — Permits pilot to perform target acquisition. STOW — Stows TSU dead-ahead.
PHS ACQ Switch Located on Instrument Panel	Slaves TSU to pilot HS for target acquisition when pressed.
CONST OVRD Switch	Permits TOW firing when helicopter is not aligned within the attack envelope when pressed.

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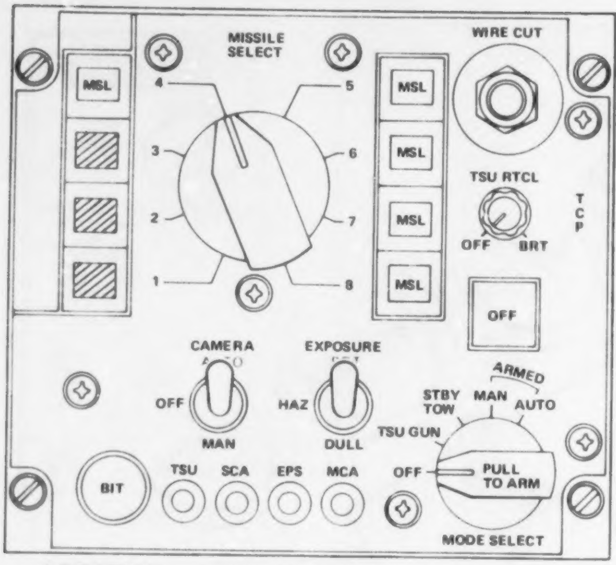
Figure 4.2-18. Gunner Sight Hand Control (SHC)



LOCATION: GUNNER INSTRUMENT PANEL

ITEM	FUNCTION
MODE SELECT Switch	OFF — Deactivates TSU and TMS circuits. TSU/GUN — Permits gunner to fire turret and perform target acquisition, pilot to fire wing stores (not TOW) and perform target acquisition. STBY TOW — Permits gunner to control TMS/perform target acquisition, pilot to fire turret/ wing stores (not TOW) and perform target acquisition. MAN — Permits gunner to fire TOW (manually selected) and perform target acquisition, pilot to fire turret/ wing stores (not TOW) and perform target acquisition. AUTO — Same as MAN except missile is automatically selected.

ITEM	FUNCTION	
TSU/SCA/ EPS/MCA Unit Fail Indicators	Black Flag White Flag	— Indicates unit operational during performance or built-in-test. — Indicates unit failure during performance or built-in-test. EPS indicates failure during performance, built-in-test, or nonperformance.
BIT Switch		Performs manual built-in-test when pressed.
CAMERA Switch		Not used.
EXPOSURE Switch		Not used.
OFF/PWR ON/ ARMED/TEST System Status Annunciator	OFF PWR ON ARMED TEST	— Indicates MODE SELECT switch is in the OFF position. — Indicates MODE SELECT switch is in the TSU/GUN or STBY TOW position. — Indicates MODE SELECT switch is in the ARMED position. — Indicates built-in-test is being performed.
TSU RTCL Switch	OFF	— Deactivates the TSU reticle circuit. Varies intensity of TSU reticle lights when turned.
WIRE CUT Switch		Permits gunner to manual cut missile command wire when pressed.
MSL/Barberpole Missile Status Indicators	MSL Barberpole	— Indicates missile is present in a specific location of launcher. — Indicates missile is not present in a specific location of launcher.
MISSILE SELECT Switch	1/2/3/4/ 5/6/7/8	— Indicates missile selected (manual or automatic) for firing.

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Figure 4.2-19. Gunner TOW Control Panel (TCP)

l. Azimuth drive assembly — Check locking lever locked (down) condition and security.

2. Ammunition bay right side — Check.

   a. Bay door — Open.

   b. Ammunition box — Check condition, security, and quick-release pins.

   c. Boost motor — Check condition and security, electrical connector connected.

   d. Ammunition chute — Check condition, security, and ammunition present.

   e. Bay door — Close and secure.

3. Turret left side — Check.

   a. Gun mounting — Quick-release pins (ring up) installed through gun saddle holes and recoil adapter, recoil adapter secure on cradle.

   b. Elevation drive motor — Check condition and security, electrical connector connected. Locking lever locked (down).

   c. Gun drive assembly — Check condition and security, electrical connector connected.

4. Ammunition bay left side — Check.

   a. Bay door — Open.

   b. Ammunition box — Check condition, security, and quick-release pins.

   c. Ammunition chute — Check condition, security, and ammunition present.

   d. Electrical cables/connectors — Check condition and security.

   e. Bay door — Close and secure.

(O) 5. TOW — Check.

   a. Launcher mounting — Check upper launcher aft and forward adjustable bomb lugs secure to helicopter ejector racks and rack swaybrace bolts firmly against launcher swaybrace pads. Lower launcher aft and forward attaching points secure to upper launcher aft and forward attaching points.

   b. Electrical connector — Check upper launcher harness connected to helicopter receptacle and jettison quick disconnect lanyard attached to harness and launcher. Lower launcher harness connected to upper launcher harness receptacle.

   c. Missile installation — Check missile front ring seated in forward tube mating ring, hinged center gate and debris director secure with captive locking pins. Note number of and position of installed missiles (needed for interior check).

(O) 6. Rocket launcher — Check.

   a. Launcher mounting — Check launcher aft and forward bomb suspension lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against launcher but not denting exterior.

   b. Electrical connection — Check harness connected to launcher and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and launcher.

   c. Launcher — Check launcher exterior and tube interiors for damage and corrosion.

   d. Rocket installation — Check rocket aft end secure in launcher tube aft detent.

   e. Igniter arms — Check for damage and corrosion.

(O) 7. Wing gun pod — Check.

   a. Front fairing — Removed.

   b. Bullet trap — Installed.

c. Pod mounting — Check pod front and rear lugs secure to helicopter ejector racks. Rack swaybrace bolts firmly against pod but not denting exterior.

d. Electrical connection — Check harness connected to pod and helicopter receptacles. Jettison quick disconnect lanyard attached to harness and pod.

e. Pod — Check exterior for condition (includes front fairing removed during step a.).

f. Gun barrel clamp and retaining bolt — Check secure.

g. Gun mounting — Check recoil adapters, quick-release pins, and rear mount secure.

h. Gun gate solenoid — Check plunger returns to extended position when pressed, electrical connectors condition and security.

i. Gun exit unit — Check condition and security.

j. Gun feeder wheel — Check condition and security.

k. Gun electrical drive — Check drive and electrical connectors condition and security.

l. Gun safing sector — Secure.

m. Gun round counters (2) — Set.

n. Gun timing pin — Set.

o. Gun feeding timing pin — Set.

p. Gun exit unit timing pin — Set.

q. Rear fairing — Remove.

r. CHGR switch — AUTO.

s. HTR switch — As desired.

t. Firing RATE selector switch — As desired.

(O) u. FLD power start switch — BAT.

v. Battery — Check for damage, leaking cells, and corrosion.

w. Rear fairing — Replace and secure.

x. Bullet trap — Remove.

y. Front fairing — Replace and secure.

4.2-11. BEFORE STARTING ENGINE CHECK.

NOTE

Check is to be performed after BEFORE STARTING ENGINE CHECK, Chapter 8.

1. Armament switches — Set.
   a. PSI — Elevation/azimuth sightline position bars centered on reference ring, coarse scale azimuth pointer centered. ATTK/RDY/FIRE annunciators and ascent/descent pointers not displayed.
   b. Gunner SHC ACQ/TRK/STOW switch — STOW.
   c. Gunner TCP MODE SELECT switch — OFF, system status annunciator displays OFF.
   d. Gunner TCP CAMERA switch — OFF.
   e. Gunner TCP EXPOSURE switch — DULL.
   f. Gunner TCP TSU RTCL switch — OFF.
   g. Gunner TCP MISSILE SELECT switch — 1.
   h. Gunner RD RMNG indicator/selector — Set.
   i. Gunner SLEW RATE switch — NORM.

4.2-12. ARMAMENT—SYSTEMS CHECK.

WARNING

The following checks shall not be performed with TOW missiles installed.

1. HSS built-in-test — Check.

   a. Pilot and gunner HS arm assemblies — Attached to BIT magnets.

   b. Pilot MASTER ARM switch — STBY.

   c. Pilot WPN CONTR switch — GUNNER.

   d. Indicator light test — Press pilot and gunner ARMED/STBY, gunner PILOT IN CONT and PLT/GNR/EIA/GO panels. All sections illuminate.

   e. Gunner HSS BIT switch — BIT. Test passed if GO lights illuminates, failed if PLT/GNR/EIA lights illuminate. If failed, ensure HSS arm assemblies are properly attached to BIT magnets, check all cable connections, and actuate BIT switch again.

NOTE

If failure occurs, recycle MASTER ARM switch and do not use failed station.

2. HSS to turret — Check.

   a. Pilot and gunner HS arm assemblies — Attach to helmet.

   b. Pilot and gunner HS eyepieces — Extended over eye.

   c. Gunner reticle — Adjust, focus, and test lights. HSS OFF BRT control to be in full BRT. After adjust and focus, press HSS RTCL TEST switch. If reticle goes out, one or more lights may have failed. Release TEST switch.

CAUTION

Do not drive turret to stops during this check.

   d. Gunner HS to turret check — TSU left hand grip ACTION switch pressed, gunner moves head, turret follows head movement. Gunner makes rapid rotational head movement, reticle flashes until gun line is coincident with HS line. Release ACTION switch.

WARNING

In the following check, do not press the gunner cyclic TRIGGER TURRET FIRE switch.

   e. Gunner emergency mode check — Gunner PLT ORIDE switch in PLT ORIDE and cyclic TRIGGER ACTION switch pressed. Make head movements as required in step d. above, then PLT ORIDE switch to OFF.

   f. Pilot WPN CONTR switch — PILOT. Pilot reticle — Adjust, focus and test light. HSS RTCL OFF BRT control to be in full BRT. After adjust and focus, press HSS RTCL TEST switch. If reticle goes out, one or more lights may have failed. Release TEST switch.

   g. Pilot HS to turret check — Cyclic TRIGGER ACTION switch pressed, pilot moves head, turret follows head movement. Pilot makes rapid rotational head movement, reticle flashes until gun line is coincident with HS line. Release TRIGGER ACTION switch.

3. TOW built-in-test — Check.

   a. Pilot WPN CONTR switch — GUNNER.

   b. Gunner TCP MODE SELECT switch — STBY TOW, system status annunciator OFF, after 10 seconds. TEST, before two minutes PWR ON, TSU/SCA/EPS/MCA fail indicators display black flags. Black flag indicates automatic BIT passes, white flag indicates failure.

   c. Gunner TCP BIT switch — Hold, gunner TSU reticle ATTK/RDY/GUNS indicators, pilot PSI ATTK/RDY/FIRE annunciators, and ascend/descend pointers displayed. Release switch.

d. Gunner TCP missile status indicators — Displays missile load configuration noted during exterior check.

e. BIT override check — TCP MODE SELECT switch OFF, then STBY TOW, when TCP annunciator displays TEST, move ACQ/TRK/STOW switch from STOW to TRK annunciator displays PWR ON.

f. TOW BIT (performed above) information. Automatic or manual BIT may be performed before, during, or after operations.

(1) TOW BIT initiation.

(a) Gunner SHC ACQ/TRK/STOW switch — STOW.

(b) Automatic BIT — Gunner TCP MODE SELECT switch from OFF to TSU/GUN or STBY TOW.

(c) Manual BIT — When gunner TCP system status annunciator displays PWR ON, press and release TCP BIT switch. In the event of a BIT failure repeat as many times as necessary to verify failure.

(2) TOW BIT termination.

(a) Automatic or manual BIT — Automatically completed within two minutes.

(b) Termination during BIT. Gunner SHC ACQ/TRK/STOW switch set to ACQ or TRK or TCP MODE SELECT switch set to MAN ARMED, AUTO ARMED, or OFF.

4. TSU fast rate tracking — Check.

a. Focus knob — Rotate counterclockwise to stop.

b. Gunner — Look into TSU eyepiece.

c. TCP MODE SELECT switch — STBY TOW.

d. SHC ACQ/TRK/STOW switch — TRK.

e. LHG MAG switch — HI. Switch must be positively held in position before releasing. TSU eyepiece displays high magnification (13 power) of target.

f. Focus knob — Rotate clockwise until focus is obtained.

g. LHG MAG switch — LO. Switch must be positively held in position before releasing. TSU eyepiece displays low magnification (two power) of target.

h. SHC track control stick — Move full left and down. TSU rapidly moves left and down.

i. SHC track control stick — Release. TSU view not rotating. Pilot PSI azimuth sight-line position bar and coarse scale azimuth pointer full left, elevation sightline position bar full down.

5. TSU slow rate tracking — Check.

a. Gunner — Look into TSU eyepiece during check.

b. MODE SELECT switch — STBY TOW.

c. LHG MAG switch — HI. Switch must be positively held in position before releasing. TSU eyepiece displays high magnification (13 power of target.

d. SHC track control stick — Move full right and up. TSU slowly moves right and up.

e. SHC track control stick — Release. TSU view not rotating. Pilot azimuth sightline position bar and coarse scale azimuth pointer full right, elevation sightline position bar full up.

6. TSU motion compensation — Check.

a. Gunner — Look into TSU eyepiece during check.

b. LHG ACTION switch — Press.

c. SHC track control stick — Move left and down. Release when TSU starts moving, TSU continues to move.

d. LHG ACTION switch — Release. TSU stops.

7. TSU stow position and reticle — Check.

a. Gunner — Look into TSU eyepiece during check.

b. TSU RTCL switch — Rotate. Reticle light intensity varies.

c. SHC ACQ/TRK/STOW switch — STOW. TSU returns to stow position.

8. HSS to TSU — Check.

a. Pilot and gunner HS eyepieces — Extended over eye.

b. Gunner HS reticle—On a target.

c. SHC ACQ/TRK/STOW switch—ACQ.

d. SHC ACQ/TRK/STOW switch — Released. Returns to TRK. Gunner HS eyepiece retracts.

e. TSU reticle — Displays target.

f. Gunner HS eyepiece — Extended over eye.

g. Pilot HS reticle—On another target.

h. PHS ACQ switch—Press. Gunner HS eyepiece retracts.

i. PHS ACQ switch—Released.

j. TSU reticle—Displays pilot target.

9. ARMS bit — Check.

a. MASTER ARM switch — STBY.

b. Pilot ARMS TEST switch—Press. Test passed if during the first sequence all RND REM display segments display a lighted 8 indicating all segments operational, and if during second sequence a lighted 7 is displayed in all positions indicating all LRUs operational. During this check, ZONE ARM lights should illuminate.

4.2-13. BEFORE TAKEOFF CHECK — ALL ARMAMENT.

1. Gunner PLT ORIDE switch — OFF.
2. Pilot MASTER ARM switch — OFF or STBY.
3. TCP—TSU/GUN.
4. TOW launchers—Missile arming lever down.
5. Wing ejector rack jettison safety pins — Removed.

4.2-14. INFLIGHT PROCEDURES — ALL ARMAMENT.

The following armament inflight procedure paragraphs are based on only one weapon installed, all armament circuit breakers in, and armament preflight interior check performed. Refer to figure 4.2-3 for firing modes when two or more weapons are installed.

4.2-15. TURRET OPERATION — INFLIGHT PROCEDURES.

CAUTION

The M-197 gun is restricted to a firing schedule not to exceed a 450-round burst with a minimum of 6 minutes cooling time prior to firing the remaining 300 rounds.

NOTE

The possibility of interruptive fire exists at anytime the gun is fired at a near 0 degree azimuth with the helicopter in an extreme nose down attitude. This is due to the gun reaching the upper limit.

1. Gunner operation (turret) is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONTR switch — GUNNER.

c. Pilot ZONE ARM switches — OFF.

d. Pilot RECOIL switch — COMPEN.

e. Gunner PLT ORIDE switch — OFF.

f. Gunner RANGE switch — As desired.

g. Gunner A/S switch — COMPEN.

h. Gunner TURRET DEPR LIMIT switch — OFF.

i. Gunner SLEW RATE switch — NORM.

j. Gunner TCP MODE SELECT switch–OFF/TSU/GUN with ATS switch to STOW, when using helmet sight (HS). TSU/GUN when using TSU, ATS must be in track.

k. Gunner LHG ACTION switch — Pressed.

l. Gunner HS/TSU reticle — On target.

m. Gunner LHG TRIGGER switch — Pressed.

n. Emergency procedures — Refer to paragraph 9-53.

2. Pilot operation (turret) — Accomplish.

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONTR switch — PILOT when using helmet sight (HS), FIXED when using reflex sight.

c. Pilot ZONE ARM switches — OFF.

d. Pilot RANGE switch — As desired.

e. Pilot RECOIL switch — COMPEN.

f. Gunner PLT ORIDE switch — OFF.

g. Gunner TURRET DEPR LIMIT switch — OFF.

h. Gunner SLEW RATE switch — NORM.

i. Pilot reflex sight — Set when using reflex sight.

j. Pilot cyclic TRIGGER ACTION switch — Pressed when using HS.

k. Pilot HS/reflex sight reticle — On target.

l. Pilot cyclic TRIGGER TURRET FIRE switch — Pressed.

m. Emergency procedures — Refer to paragraph 9-53.

4.2-16. TOW OPERATION — IN-FLIGHT PROCEDURE.

1. TOW firing is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WPN CONTR switch — GUNNER.

c. Gunner TCP MODE SELECT switch — ARMED MAN for manual missile selection, ARMED AUTO for automatic missile selection. TCP system status annunciator displays ARMED.

d. Gunner TSU LHG MAG switch — LO. Switch must be positively held in position before releasing.

e. Gunner TSU reticle — Focus.

f. Gunner TCP MISSILE SELECT switch — Set to first loaded missile, pilot informed of missile selected, pilot MSI displays L or R to indicate missile has been selected for launching from left or right launcher.

g. Gunner HS reticle — On target.

h. Gunner SHC ACQ/TRK/STOW switch — ACQ.

i. Gunner SHC ACQ/TRK/STOW switch — TRK.

j. Gunner TSU reticle — On target.

k. Gunner TSU LHG MAG switch — HI. Switch must be positively held in position before releasing.

l. Gunner SHC track control stick — Move as required to keep TSU crosshairs on target.

m. Gunner TSU LHG ACTION switch — Pressed. Gunner TSU reticle ATTK indicator comes on, pilot PSI ATTK annunciator appears. Keeping the TSU LHG ACTION switch pressed provides motion compensation by the TSU for a target during tracking.

n. Helicopter position — Maneuvered to align pilot PSI sightline position bars within prelaunch constraint boundary and maintained a roll attitude of less than ±5°. Gunner TSU reticle RDY indicator comes on, pilot PSI RDY annunciator appears.

o. Gunner TSU LHG TRIGGER switch — Pressed when helicopter is within range of target. Pilot PSI FIRE annunciator appears. After 1.5 seconds, pilot PSI ATTK and RDY annunciators disappear, gunner TSU reticle ATTK and RDY indicators go out. Gunner cannot fire if the helicopter is not within the prelaunch constraint boundary. Gunner can override the prelaunch constraint boundary limitation by pressing the CONST OVRD switch on the SHC. If this mode of operation is employed, degraded system performance can be expected. Smoke may emerge from launcher after trigger is pressed and before missile exits launcher. The smoke is caused by the missile gyro and battery squibs firing and should not be regarded as a misfire. A misfire has occured if the missile fails to exit launcher within 1.5 seconds (pilot PSI RDY annunciator disappears). After missile firing, release TSU LHG TRIGGER switch. Do not press the LHG TRIGGER during wire cutting because another missile will be launched if the TCP MODE SELECT switch is in the ARMED AUTO position and the helicopter is within prelaunch constraints.

WARNING

Do not turn helicopter to the side from which a missile is fired. The helicopter may strike the command wire.

p. Gunner LHG TRIGGER switch — Release.

q. Gunner LHG ACTION switch — Release.

r. Helicopter position — Maneuvered to keep pilot PSI sightline position bars within postlaunch constraint boundary until wire cut or missile impact.

CAUTION

Loss of missile guidance could result if a maneuver exceeding post launch constraint boundary is made.

Firing TOW missiles over high voltage lines may result in damage to TOW sytem.

s. Gunner TSU reticle crosshairs — On target until wire cut or missile impact. Gunner SHC track control stick used to keep crosshairs on target.

t. WIRE CUT button — Press.

u. Additional missile firing — The next missile is selected automatically if the gunner TCP MODE SELECT switch is on ARMED AUTO, manually selected if the switch is on ARMED MAN by the MISSILE SELECT switch.

(1) Pilot MSI — Displays L or R for missile selected.

(2) Gunner TSU LHG MAG switch — LO. Switch must be positively held in position before releasing.

(3) Fire missile — Repeat paragraphs 4.2-16.g through 4.2-16.u.

v. Emergency procedures — Refer to paragraph 9-52.

4.2-17. ROCKET OPERATION — IN-FLIGHT PROCEDURES.

1. Rocket firing is accomplished as follows:

a. Pilot MASTER ARM switch — ARM.

b. Pilot WING STORE switch — RKT.

c. RMS QTY selector — As desired.

d. RMS ZONE ARM switches — As desired.

e. RMS MODE switch — As desired.

f. RMS RATE switch — As desired.

g. RMS RNG-KM selector — Select estimated range.

h. RMS PEN-M selector — As desired.

i Pilot reflex sight — Adjust and align with target.

j. Pilot cyclic WING ARM FIRE switch — Press.

k. Pilot cyclic WING ARM FIRE switch — Release.

l. RMS ZONE ARM switches — Off, deselected.

m. Pilot MASTER ARM switch — OFF

4.2-18. WING GUN POD OPERATION — INFLIGHT PROCEDURES.

1. Wing gun pod firing is accomplished as follows:

   a. Pilot MASTER ARM switch — ARM.

   b. Gunner PLT ORIDE switch — OFF.

WARNING

If rockets are being fired, the pilot cyclic WING ARM FIRE switch must be released prior to moving WING STORE switch from RKT to GUN, wing gun pod rounds may detonate inflight rockets in proximity of helicopter.

   c. Pilot WING STORE switch — GUN.

   d. Pilot reflex sight —Adjust and align with target.

   e. Pilot cyclic WING ARM FIRE switch — Press.

   f. Pilot cyclic WING ARM FIRE switch — Release.

   g. Pilot MASTER ARM switch — OFF.

4.2-19. WING STORES JETTISON — INFLIGHT PROCEDURES.

Refer to Chapter 9, Section I.

4.2-20. BEFORE LANDING CHECK — ALL ARMAMENT

1. Gunner PLT ORIDE switch — OFF.
2. Pilot MASTER ARM switch - STBY.
3. TCP - TSU/GUNS.
4. Turret drive motor circuit breaker - Out.
5. GUN ELEV STOW light - Check ON.

4.2-21. BEFORE LEAVING HELICOPTER CHECK — ALL ARMAMENT.

WARNING

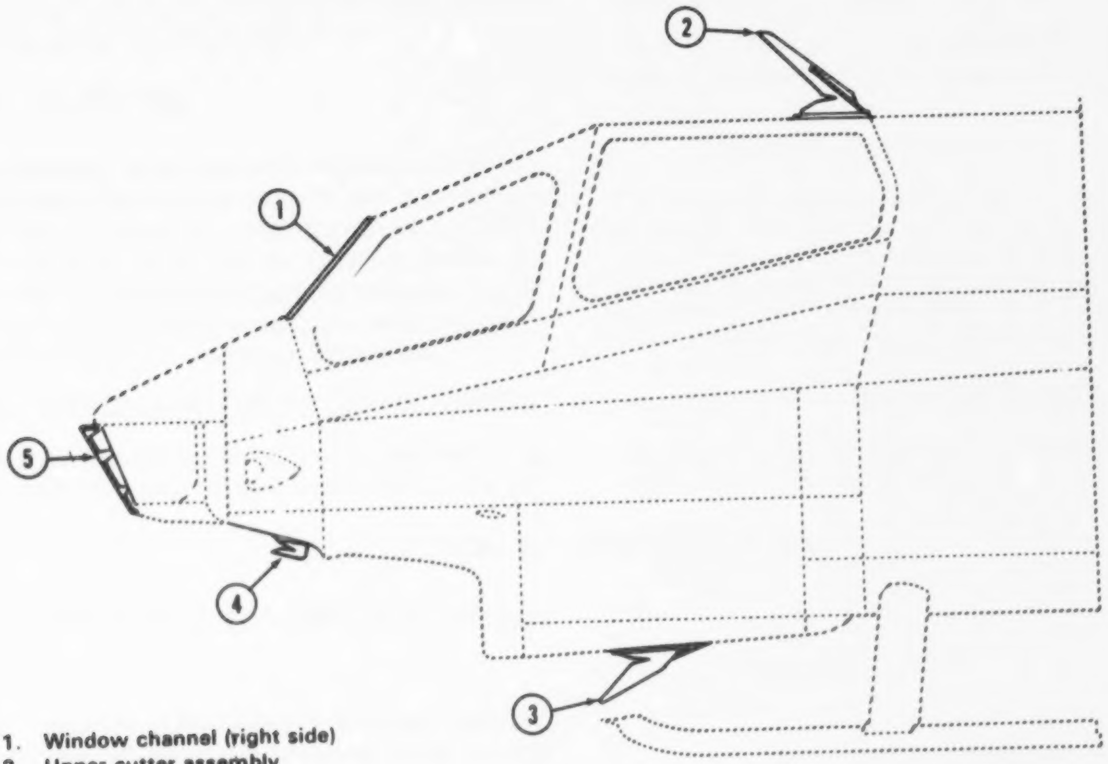
Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from EMI (electromagnetic interference).

1. Wing ejector rack jettison safety pins — Installed.
2. TOW missile arming lever — Up.
3. Rocket igniter arms — In contact with rockets. Rocket igniter arms must remain in contact with rockets to reduce possibility of ignition from electromagnetic interference (EMI).

SECTION III. PASSIVE DEFENSE

4.2-22. WIRE STRIKE PROTECTION SYSTEM.

The wire strike protection system (figure 4.2-20) consists of three cutter assemblies, a windshield channel and a nose deflector. An upper cutter assembly is mounted on top of the pilot station, forward of the ADF loop antenna. A chin cutter assembly is mounted under the nose, just forward of the gunner station. A lower cutter assembly is mounted on the forward fuselage, under the ammunition compartment. The wire strike protection system is designed to protect the helicopter from wire obstructions at low levels of flight.



1. Window channel (right side)
2. Upper cutter assembly
3. Lower cutter assembly
4. Chin cutter assembly
5. Nose deflector

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Figure 4.2-20. Wire Strike Protection System

CHAPTER 5

OPERATING LIMITS AND RESTRICTIONS

SECTION I. GENERAL

5-1. PURPOSE.

This chapter identifies or refers to all important operating limits and restrictions that shall be observed during ground and flight operations.

5-2. GENERAL.

The operating limitations set forth in this chapter are the direct results of design analysis, tests, and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the helicopter. Limits concerning maneuvers, weight, and center of gravity limitations are also covered in this chapter.

5-3. EXCEEDING OPERATIONAL LIMITS.

a. Anytime an operational limit is exceeded, an appropriate entry shall be made on DA Form 2408 - 13. Entry shall state what limit or limits were exceeded, range, time above limits, and any additional data that would aid maintenance personnel in the maintenance action that may be required.

b. The instruments in the pilot's station are the primary reference for determining aircraft operating limits.

5-3.1. FLIGHT PLANNING.

The aircraft configuration and gross weight shall be limited such that, in the event of a hydraulic system failure, a gross weight is achieveable (jettisoning wing stores as appropriate) which does not exceed that corresponding to a 5 feet IGE hover capability at the recorded torque value.

5-4. MINIMUM CREW REQUIREMENTS.

The minimum crew requirement consists of a pilot whose station is in the aft cockpit.

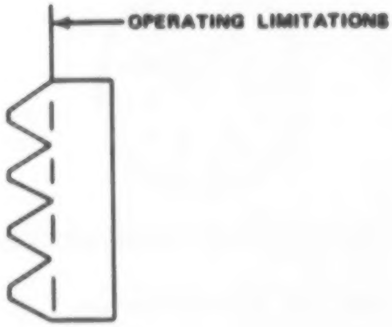
SECTION II. SYSTEM LIMITS

5-5. INSTRUMENT MARKINGS. (Figure 5-1)

a. Instrument Marking Color Codes. Operating limitations and ranges are illustrated by the colored markings which appear on the dial faces of engine, flight, and utility system instruments. RED markings on the dial faces of these instruments indicate the limit above or below which continued operation is likely to cause damage or shorten life. The GREEN markings on instruments indicate the safe or normal range of operation. The YELLOW markings on instruments indicate the range when special attention should be given to the operation covered by the instrument. Operation is permissible in the yellow range, provided no other operating limit is exceeded.

b. Chevron. A chevron (<) indicates above operating limits and to go in direction of point. The saw tooth red line is placed on the dial face with respect to the operating limit as follows:

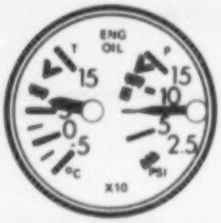
OPERATING LIMIT



5-6. ROTOR LIMITATIONS.

a. Normal Operating Range. Refer to figure 5-1.

■ R
▨ G
☐ Y

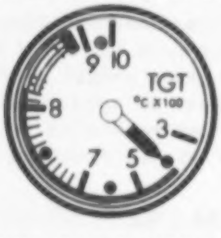

ENG
OIL
T
P
15
10
5
0
.5
15
10
5
2.5
°C
X10
PSI

ENGINE OIL PRESSURE

■ 80 to 100 PSI Continuous Operation
▲ 25 PS! Minimum
▼ 100 PSI Maximum

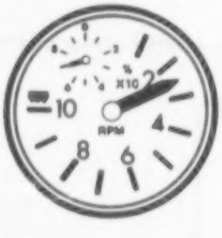
ENGINE OIL TEMPERATURE

▼ 93°C maximum below 30°C FAT
100°C maximum at or above 30°C FAT
(Write-up is required any time 93°C is exceeded.)


9
10
TGT
°C X100
8
3
7
5

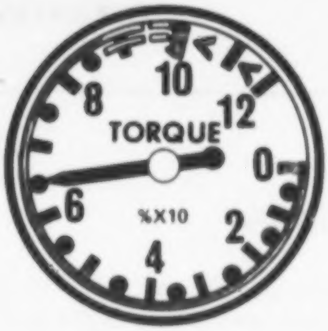
TURBINE GAS TEMPERATURE

■ 400°C to 820°C Continuous Operation (Normal Power)
☐ 820°C to 880°C 30 Minute Limit (Military Power)
▼ 880°C thru 950°C Transient for Starting and Acceleration (5 sec)
● 950°C Maximum for Starting


%
X10
10
RPM
2
4
8
6

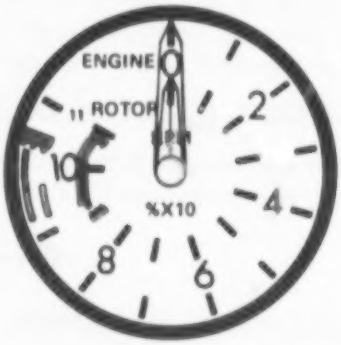
GAS PRODUCER TACHOMETER (N_1)

▼ 106 Percent Maximum


8
10
12
TORQUE
0
6
%X10
2
4

TORQUE PERCENT

■ 0 To 88 Percent Continuous Operation
☐ 88 To 100 Percent 30 Minute
▼ 100 Percent Calibrated Torque Maximum.
Refer to Chapter 7 for indicated torque values.


ENGINE
ROTOR
11
10
2
%X10
4
8
6

ROTOR TACHOMETER

▲ 91 Percent RPM Minimum
■ 91 to 105 Percent RPM Continuous Operation
▼ 105 Percent RPM Maximum

ENGINE TACHOMETER (N_2)

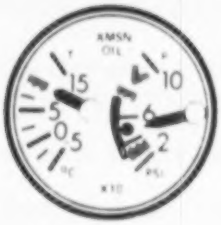
☐ 91 to 97 Percent RPM Transient
■ 97 to 100 Percent RPM Continuous Operation
▼ 101.5 thru 104.5 percent RPM Maximum
Transient with TGT above 750°C (10 seconds).

104.5 Percent RPM Maximum

R ■
G ▨
Y ☐

209078-23-1G

Figure 5-1. Instrument Markings (Sheet 1 of 2)


XMSN
OIL
15
5
0
5
10
6
2
°C
PSI
X10

TRANSMISSION OIL PRESSURE

🟥 30 PSI Minimum

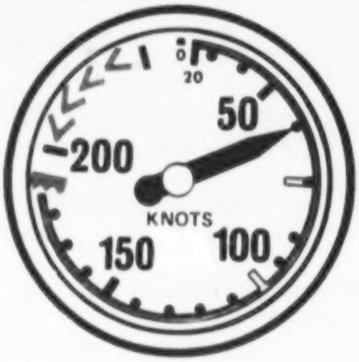
🟩 40 to 70 PSI Continuous Operation

🟨 30 to 40 PSI only below 91% (N$_2$)

🟥 70 PSI Maximum

TRANSMISSION OIL TEMPERATURE

🟥 110°C Maximum


0
20
50
200
KNOTS
150
100

AIRSPEED

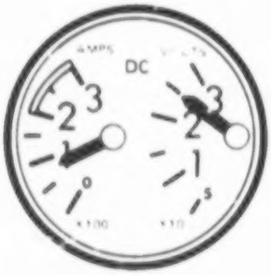
🟨 70 KIAS Not Applicable

🟨 100 KIAS Above 88% torque

🟩 0 TO 190 KIAS

🟥 190 KIAS

See Figure 5-3 for Additional Limitations


AMPS
DC
VOLTS
3
2
1
0
3
2
1
5
X100
X10

VOLT/AMP METER

🟨 Transient. Operation in the yellow area may induce generator life.

209078-23-2G

Figure 5-1. Instrument Marking (Sheet 2 of 2)

b. **Wind Limitations.** The helicopter can be started in a maximum wind velocity of 30 knots or a maximum gust spread of 15 knots. Gust spreads are not normally reported. To obtain spread, compare minimum and maximum wind velocity.

SECTION III. POWER LIMITS

5-7. ENGINE LIMITATIONS. (Figure 5-1).

a. **Engine Overspeed:** An engine overspeed exists under the following conditions:

(1) When N1 exceeds 106 percent.

(2) When N2 exceeds 104.5 percent.

(3) When N2 is between 101.5 percent and 104.5 percent for more than ten seconds with TGT above 750°C.

NOTE

The red line at 100 percent on the engine tachometer (figure 5-1) represents the power-on rotor speed limit. Even though an engine write-up is not required unless the rpm limits of paragraph 5-7a (2) and (3) are exceeded, willful operation shall not be conducted with engine rpm above the red line limit of 100 percent.

b. Maximum oil consumption is 0.3 gal. (2.4 pints) per hour.

c. Maximum starter energize time is 35 seconds with a one minute cooling time between start attempts with three attempts in any one hour.

d. Maximum TGT for environmental control system operation is 820°C.

e. 91 to 97 percent N2 transient.

5-8. Deleted.

5-9. Deleted.

All data on pages 5-6 and 5-7 including Figure 5-2 is deleted.

SECTION IV. LOADING LIMITS

5-10. CENTER OF GRAVITY LIMITATIONS.

Center of gravity limits for the aircraft to which this manual applies and instructions for computation of the center of gravity are contained in Chapter 6.

NOTE

The lateral cg limits are 2.0 inches (2 inches to the right and left of centerline of helicopter). These limits can not be exceeded due to normal weapon firing sequence and stores jettison procedure.

5-10.1. TURBULENCE RESTRICTIONS.

Intentional flight into severe or extreme turbulence is prohibited.

5-11. WEIGHT LIMITATIONS.

The maximum gross weight for this helicopter is 10,000 pounds.

SECTION V. AIRSPEED LIMITS

5-12. AIRSPEED LIMITATIONS.

a. Refer to Figure 5-3 for forward airspeed limits.

b. Sideward flight is 35 knots.

c. Rearward flight limit is 30 knots.

d. Maximum steady-state airspeed with SCAS OFF is 100 knots. With the SCAS inoperative and at an airspeed in excess of 100 KIAS, uncommanded roll, pitch and yaw oscillations will occur. The magnitude of the oscillation will increase as airspeed increases. Due to the nature of the oscillation, there is a tendency to introduce pilot induced oscillations which further aggrevate the condition. Additionally, high power setting should be avoided when operating at airspeeds between 60 and 100 KIAS with inoperative roll and yaw SCAS channel because of instability.

e. Maximum steady-state autorotational airspeed is 120 knots.

f. Maximum airspeed for TOW missile firing is 150 knots.

g. Airspeed limit for indicated torque greater than 62.5 percent is 150 KIAS.

5-13. CANOPY DOOR LIMITATIONS.

The canopy door shall not be opened anytime engine rpm is above idle with collective at other than full down, except as outlined in emergency procedures in Chapter 9.

AIRSPEED OPERATING LIMITS

100% RPM

AIRSPEED
OPERATING
LIMITS
AH-1S
T53-L-703

EXAMPLE

WANTED

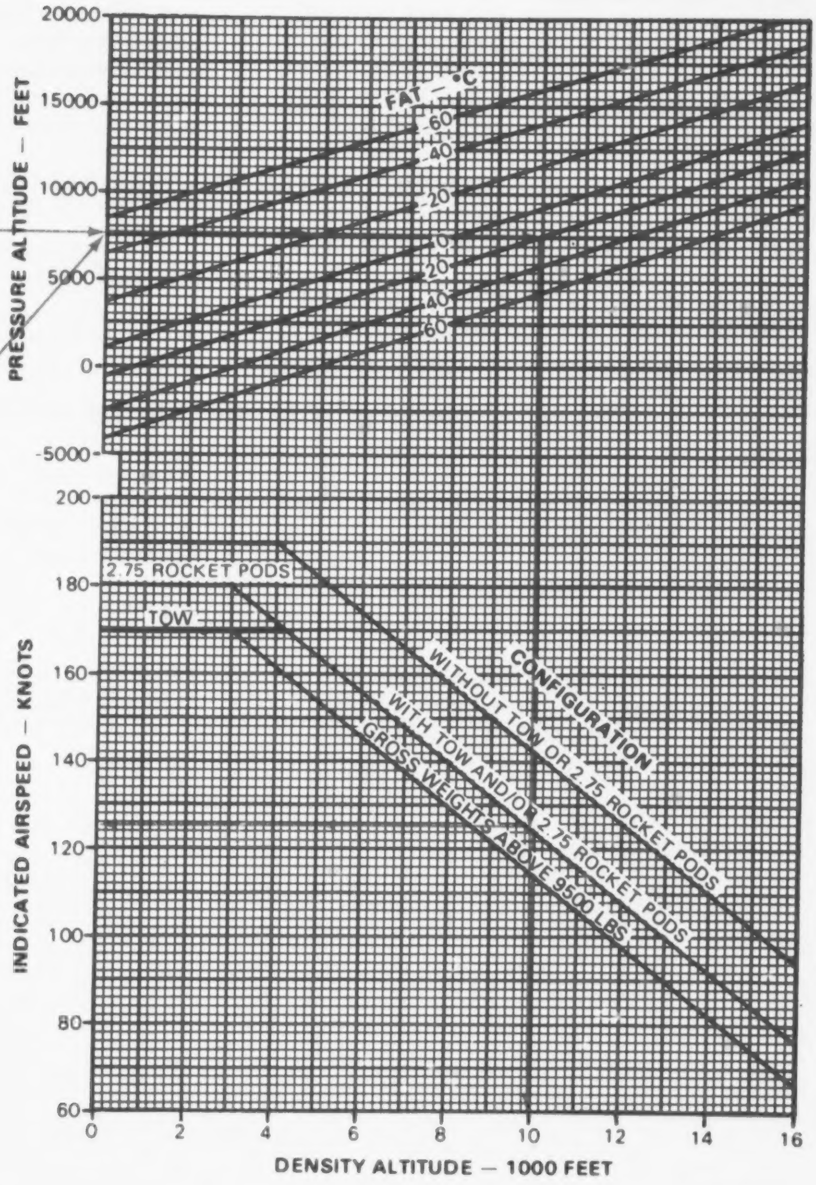
INDICATED AIRSPEED
AND DENSITY ALTITUDE

KNOWN

TOW CONFIGURATION
PRESSURE ALTITUDE = 7500 FEET
FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CONFIGURATION
MOVE LEFT, READ INDICATED
AIRSPEED = 124 KNOTS
REENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ DENSITY
ALTITUDE = 10000 FEET



209900-507A

DATA BASIS: DERIVED FROM BELL HELICOPTER TEXTRON FLIGHT TEST

Figure 5-3. Airspeed Operating Limits Chart

SECTION VI. MANEUVERING LIMITS

5-14. PROHIBITED MANEUVERS.

a. Abrupt inputs of flight controls cause excessive main rotor flapping, which may result in mast bumping and must be avoided.

b. No aerobatic maneuvers permitted.

c. Intentional flight below + 0.5 "g's" is prohibited. Refer to "Low G Manuevers", Chapter 8, paragraph 8-41.

d. Practice autorotations and/or rapid throttle-setting reduction at airspeeds greater than 150 KIAS are prohibited when indicated engine torque pressure is greater than 62 percent.

e. The speed for any and all maneuvers shall not exceed the airspeeds as stated on the Airspeed Operating Limit Chart, Figure 5-3.

SECTION VII. ENVIRONMENTAL RESTRICTIONS

5-15. ENVIRONMENTAL RESTRICTIONS.

a. This helicopter is not qualified for flight under instrument meteorlogical condition.

b. Environmental restrictions; refer to Section III and V of Chapter 8.

SECTION VIII. HEIGHT VELOCITY

5-16. Deleted.

CHAPTER 6

WEIGHT/BALANCE AND LOADING

SECTION I. GENERAL

6-1. GENERAL.

Chapter 6 contains sufficient instructions and data so that an aviator knowing the basic weight and moment of the helicopter can compute any combination of weight and balance.

6-2. CLASSIFICATION OF HELICOPTER.

For the purpose of clarity, Army AH-1P/E/F helicopters are in class 2. Additional directives governing weight and balance of class 2 helicopter forms and records are contained in AR 95-16, DA PAM 738-751 and TM 55-1500-342-23.

6-3. HELICOPTER STATION DIAGRAM.

Figure 6-1 shows the helicopter reference datum lines, fuselage stations, buttlines, and waterlines. The primary purpose of the figure is to aid personnel in the computation of the helicopter weight/balance and loading.

6-4. LOADING CHARTS.

a. **Information.** The loading data contained in this chapter are intended to provide information necessary to work a loading problem for the helicopters to which this manual is applicable.

b. Use. From the figures contained in this chapter, weight and moment are obtained for all variable load items and are added to the current basic weight and moment to obtain the gross weight and moment.

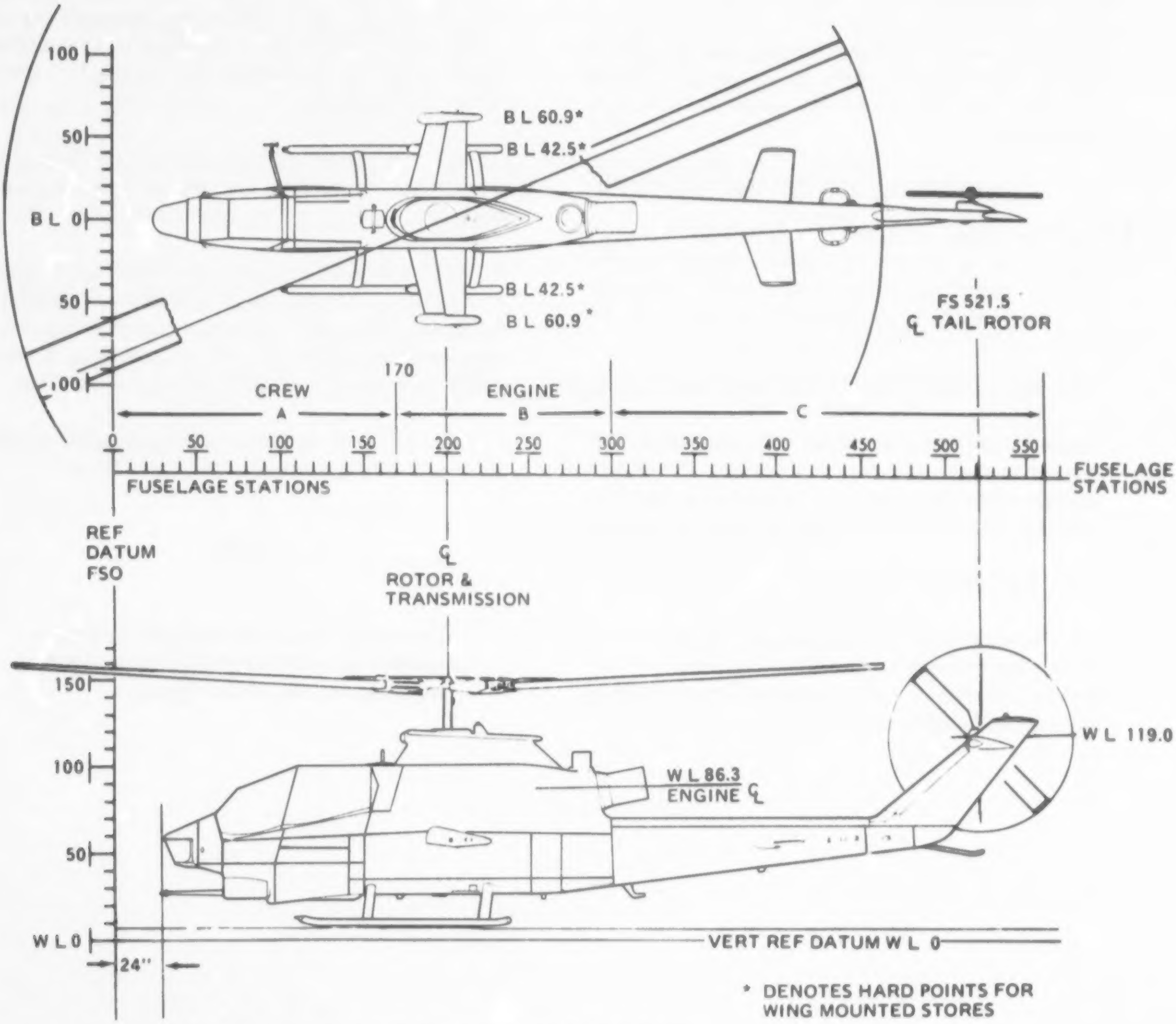
(1) The gross weight and moment are checked on figure 6-9 to determine the approximate center of gravity (cg).

(2) The effect on cg by the expenditures in flight of such items as ammunition, etc., may be checked by subtracting the weights and moments of such items from the takeoff weight and moment and checking the new weight and moment on the Loading Limits Chart.

(3) If the weight and moment lines do not intersect, the cg is not within the flight limits.

NOTE

This check should be made to determine whether or not the cg will remain within limits during the entire flight.


100
50
B L 0
50
100
B L 60.9*
B L 42.5*
B L 42.5*
B L 60.9*
FS 521.5
℄ TAIL ROTOR
170
CREW
A
ENGINE
B
C
0
50
100
150
200
250
300
350
400
450
500
550
FUSELAGE STATIONS
FUSELAGE STATIONS
REF
DATUM
FSO
℄
ROTOR &
TRANSMISSION
150
100
50
W L 0
W L 119.0
W L 86.3
ENGINE ℄
VERT REF DATUM W L 0
24"
* DENOTES HARD POINTS FOR
WING MOUNTED STORES

NOTE: FUSELAGE STATIONS AND MOMENT ARMS ARE THE SAME.

209900-817A

Figure 6-1. Helicopter Station Diagram (Typical)

SECTION II. WEIGHT AND BALANCE

6-5. WEIGHT AND BALANCE RECORDS.

Weight and Balance forms are maintained in the helicopter historical file. Refer to Section II, TM 55-1500-342-23 for additional information on DD Forms 365-1, -3 and -4.

SECTION III. PERSONNEL

6-6. PERSONNEL MOMENTS.

Refer to figure 6-2 to compute pilot and gunner moments.

EXAMPLE

WANTED

PERSONNEL MOMENT

KNOWN

PERSONNEL WEIGHT = 180 POUNDS

SEAT POSITION IS GUNNER (FRONT) SEAT

METHOD

MOVE RIGHT FROM 180 POUNDS TO GUNNER POSITION LINE. PROJECT DOWN TO READ MOMENT/100 OF 150 IN-LBS

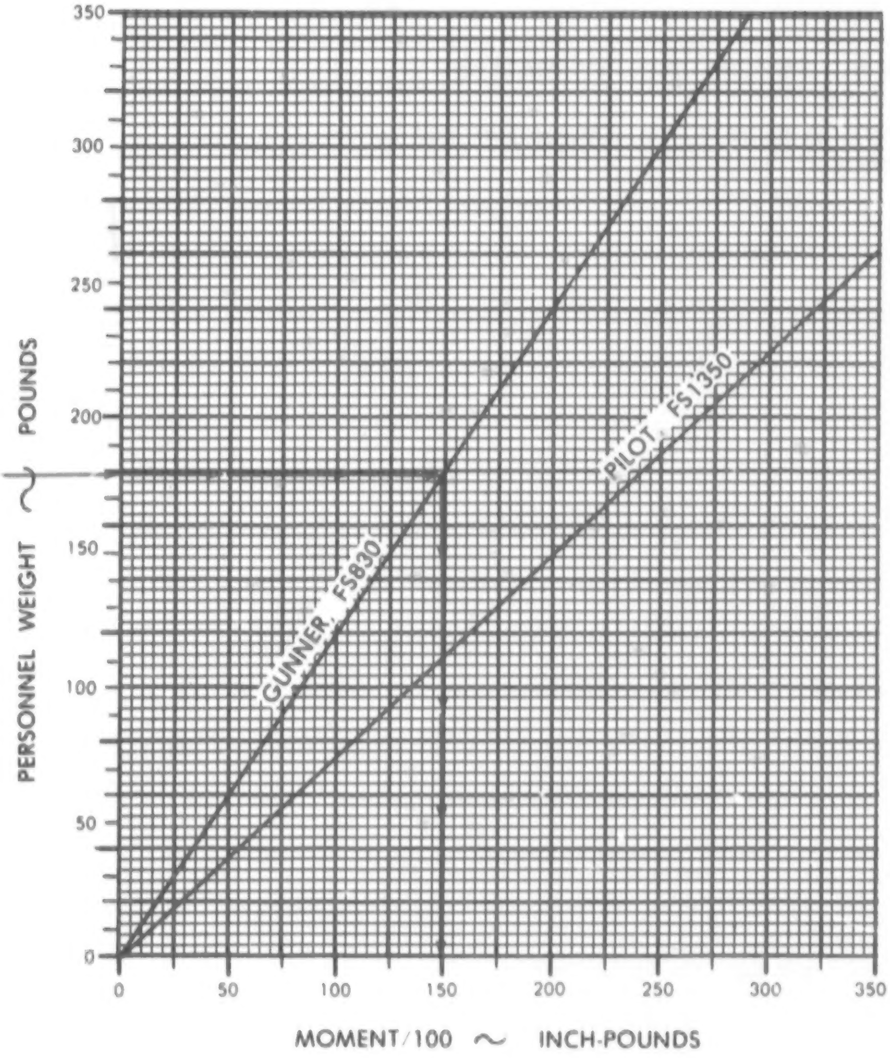


Figure 6-2. Personnel Moment Chart

SECTION IV. MISSION EQUIPMENT

6-7. WEIGHT AND BALANCE LOADING DATA.

Refer to figures 6-3 through 6-7 for the quantity, weight, and moment of each armament item up to maximum load.

6-8. 2.75 ROCKETS/19 ROUND PODS OUTBOARD WING STATIONS.

There are significant differences in the individual weights of available 2.75 rockets that can be installed. The weight differences pose no structural concern on the inboard wing stations. However, there is a limitation on the outboard wing stations of 12 heavy warhead rockets due to limited fatigue life predictions for the wing to fuselage attachment lugs. There are no outboard station limitations for the light warhead rockets.

These rocket weight differences are primarily due to the various types of warheads that range in weight from approximately 8.7 to 16.1 pounds. Also warhead weight variation of the forward end of the rockets drastically changes the pitch and yaw inertias of the overall rocket. Refer to figure 6-4 for outboard wing station loading.

LAUNCHER	WEIGHT (POUNDS)	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
M2[illegible]	139	277	285
M158	42	83	85
M260	35	70	72
M261	82	159	164

209900-826A

M E Figure 6-3. 2.75 Inch Rocket Launcher Moment Chart

Heavy Warhead Rockets	Light Warhead Rockets	Total No. Of Rockets For Each Combination
12	0	12
11	1	12
10	3	13
9	4	13
8	6	14
7	8	15
6	9	15
5	11	16
4	12	16
3	14	17
2	15	17
1	16	17

M E Figure 6-4. Combination of Light and Heavy 2.75 Rockets on Outboard Wing Stations (19 Round Pod)

M151 WARHEAD/M429 FUSE
10 POUND WARHEAD WITH PROXIMITY FUSE
M40 ROCKET MOTOR

		M200A1 LAUNCHER		M261 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	21	41	42	41	43
2	42	82	84	82	85
3	62	123	126	124	128
4	83	163	169	165	170
5	104	204	211	206	213
6	125	245	253	247	255
7	146	286	295	289	298
8	166	327	337	330	340
9	187	368	379	371	383
10	208	409	422	412	425
11	229	450	464	454	468
12	250	490	506	495	510
13	270	531	548	536	553
14	291	572	590	577	595
15	312	613	632	619	638
16	333	654	675	660	680
17	354	695	717	701	723
18	374	736	759	742	765
19	395	777	801	784	808

		M158 LAUNCHER		M260 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	21	40	41	41	43
2	42	80	83	82	85
3	62	120	124	124	128
4	83	160	165	165	170
5	104	200	207	206	213
6	125	240	248	247	255
7	146	280	289	289	298

209900-822-1

M E Figure 6-5. Folding Fin Aerial Rocket Moment Chart (Sheet 1 of 6)

best copy available

M229 WAR HEAD/M423 FUSE
17 POUND WARHEAD WITH POINT DETONATING FUSE
M40 ROCKET MOTOR

		M200A1 LAUNCHER		M261 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	28	53	55	54	55
2	56	106	110	107	111
3	84	160	165	161	166
4	112	213	220	215	222
5	140	266	275	269	277
6	167	319	330	322	332
7	195	372	385	376	388
8	223	426	439	430	443
9	251	479	494	483	499
10	279	532	549	537	554
11	307	585	604	591	609
12	335	638	659	644	665
13	363	692		698	
14	391	745		752	
15	419	798		806	
16	446	851		859	
17	474	904		913	
18	502	958		967	
19	530	1011		1020	

		M158 LAUNCHER		M260 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	28	52	54	54	55
2	56	104	108	107	111
3	84	156	161	161	166
4	112	208	215	215	222
5	140	260	269	269	277
6	167	312	323	322	333
7	195	364	377	376	388

209900-822-2

M E Figure 6-5. Folding Fin Aerial Rocket Moment Chart (Sheet 2 of 6)

M156 WARHEAD/M423 FUSE
10 POUND WARHEAD WITH POINT DETONATING FUSE
M40 ROCKET MOTOR

		M200A1 LAUNCHER		M261 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	21	41	42	42	43
2	42	82	85	83	86
3	63	123	127	125	128
4	84	165	170	166	171
5	105	206	212	208	214
6	125	247	255	249	257
7	146	288	297	291	299
8	167	329	339	332	342
9	188	370	382	374	385
10	209	411	424	415	428
11	230	452	467	457	471
12	251	494	509	498	513
13	272	535	552	540	556
14	293	576	594	581	599
15	314	617	636	623	642
16	334	658	679	664	685
17	355	699	721	706	727
18	376	740	764	747	770
19	397	781	806	789	813

		M158 LAUNCHER		M260 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	21	40	42	42	43
2	42	81	83	83	86
3	63	121	125	125	128
4	84	161	166	166	171
5	105	201	208	208	214
6	125	242	250	249	257
7	146	282	291	291	300

209900-822-3

M E Figure 6-5. Folding Fin Aerial Rocket Moment Chart (Sheet 3 of 6)

M229 WAR HEAD/M429 FUSE
17 POUND WARHEAD WITH PROXIMITY FUSE
M40 ROCKET MOTOR

		M200A1 LAUNCHER		M261 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	28	54	55	54	56
2	56	107	111	108	112
3	85	161	166	163	168
4	113	215	222	217	224
5	141	268	277	271	279
6	169	322	332	325	335
7	197	376	388	379	391
8	226	429	443	433	447
9	254	483	499	488	503
10	282	537	554	542	559
11	310	590	610	596	615
12	338	644	665	650	671
13	367	698		704	
14	395	751		758	
15	423	805		813	
16	451	859		867	
17	479	912		921	
18	508	966		975	
19	536	1020		1029	

		M158 LAUNCHER		M260 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	28	53	54	54	56
2	56	105	109	108	112
3	85	158	163	163	168
4	113	210	217	217	224
5	141	263	271	271	280
6	169	315	326	325	336
7	197	368	380	379	392

209900-822-4

M E Figure 6-5 Folding Aerial Rocket Moment Chart (Sheet 4 of 6)

M247 WAR HEAD/M438 FUSE
DUAL PURPOSE WARHEAD WITH POINT DETONATING FUSE (10 POUND)
M40 ROCKET MOTOR

		M200A1 LAUNCHER		M261 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	20	39	41	40	41
2	40	79	81	80	82
3	60	118	122	119	123
4	80	158	163	159	164
5	100	197	204	199	205
6	120	237	244	239	246
7	140	276	285	279	287
8	160	316	326	319	328
9	180	355	366	358	369
10	200	395	407	398	410
11	220	434	448	438	451
12	240	474	489	478	492
13	260	513	529	518	534
14	280	553	570	557	575
15	300	592	611	597	616
16	320	632	652	637	657
17	340	671	692	677	698
18	360	711	733	717	739
19	380	750	774	757	780

		M158 LAUNCHER		M260 LAUNCHER	
		(MOMENT/100) LOCATION ON WING		(MOMENT/100) LOCATION ON WING	
NO. OF ROCKETS	WEIGHT (POUNDS)	INBOARD	OUTBOARD	INBOARD	OUTBOARD
1	20	39	40	40	41
2	40	77	80	80	82
3	60	116	120	119	123
4	80	155	160	159	164
5	100	193	200	199	205
6	120	232	240	239	246
7	140	271	279	279	287

209900-822-5A

M E Figure 6-5. Folding Fin Aerial Rocket Moment Chart (Sheet 5 of 6)

M151 WARHEAD/M423 FUSE
10 POUND WARHEAD WITH DETONATING FUSE
M40 ROCKET MOTOR

NO. OF ROCKETS	WEIGHT (POUNDS)	M200A1 LAUNCHER (MOMENT/100) LOCATION ON WING INBOARD	M200A1 LAUNCHER (MOMENT/100) LOCATION ON WING OUTBOARD	M261 LAUNCHER (MOMENT/100) LOCATION ON WING INBOARD	M261 LAUNCHER (MOMENT/100) LOCATION ON WING OUTBOARD
1	21	40	42	41	42
2	41	81	83	81	84
3	62	121	125	122	126
4	82	161	167	163	168
5	103	202	208	204	210
6	123	242	250	244	252
7	144	283	291	285	294
8	164	323	333	326	336
9	185	363	375	367	378
10	205	404	416	407	420
11	226	444	458	448	462
12	246	484	500	489	504
13	267	525	541	530	546
14	287	565	583	570	588
15	308	605	625	611	630
16	328	646	666	652	672
17	349	686	708	692	714
18	369	727	749	733	756
19	390	767	791	774	798

NO. OF ROCKETS	WEIGHT (POUNDS)	M158 LAUNCHER (MOMENT/100) LOCATION ON WING INBOARD	M158 LAUNCHER (MOMENT/100) LOCATION ON WING OUTBOARD	M260 LAUNCHER (MOMENT/100) LOCATION ON WING INBOARD	M260 LAUNCHER (MOMENT/100) LOCATION ON WING OUTBOARD
1	21	40	41	41	42
2	41	79	82	81	84
3	62	119	122	122	126
4	82	158	163	163	168
5	103	198	204	204	210
6	123	237	245	244	252
7	144	277	286	285	294

209900-822-6

M E **Figure 6-5. Folding Fin Aerial Rocket Moment Chart (Sheet 6 of 6)**

M151 WARHEAD/M423 FUSE
(10 POUND WARHEAD WITH POINT DETONATING FUSE)

M159C POD* *S/N 004041 & SUB			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	311
1	173	343	353
2	193	383	394
3	214	423	435
4	234	463	477
5	255	503	518
6	275	543	559
7	296	583	601
8	316	623	642
9	337	663	683
10	357	703	725
11	378	744	766
12	398	784	807
13	419	824	
14	439	864	
15	460	904	
16	480	944	
17	501	984	
18	521	1024	
19	542	1064	
M200A1 POD			
0	139	277	285
1	160	318	326
2	180	358	368
3	201	398	409
4	221	438	450
5	242	478	492
6	262	518	533
7	283	558	574
8	303	598	616
9	324	638	657
10	344	678	698
11	365	719	740
12	385	759	781
13	406	799	
14	426	839	
15	447	879	
16	467	919	
17	488	959	
18	508	999	
19	529	1039	

ROCKETS 20.5 LBS. EACH

P **Figure 6-5.1** Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 1 of 18)

M151 WARHEAD/M429 FUSE (10 POUND WARHEAD WITH PROXIMITY FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
M159C POD* *S/N 004041 & SUB			
0	152	302	311
1	173	343	353
2	194	384	395
3	214	424	437
4	235	465	478
5	256	505	520
6	277	546	562
7	298	587	604
8	318	627	646
9	339	667	688
10	360	708	730
11	381	749	771
12	402	790	813
13	422	830	
14	443	871	
15	464	912	
16	485	952	
17	506	993	
18	526	1033	
19	547	1074	
M200A1 POD			
0	139	277	285
1	160	318	327
2	181	359	369
3	201	399	411
4	222	440	452
5	243	480	494
6	264	521	536
7	285	562	578
8	305	602	620
9	326	642	662
10	347	683	704
11	368	724	745
12	389	765	787
13	409	805	
14	430	846	
15	451	887	
16	472	927	
17	493	968	
18	513	1008	
19	534	1049	

ROCKETS 20.8 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 2 of 18)

M229 WARHEAD/M423 FUSE
(17 POUND WARHEAD WITH POINT DETONATING FUSE)

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
M159C POD* *S/N 004041 & SUB			
0	152	302	311
1	180	355	366
2	208	408	420
3	236	461	475
4	264	514	529
5	292	567	584
6	319	620	638
7	347	672	693
8	375	725	747
9	403	778	802
10	431	831	856
11	459	884	911
12	487	937	965
13	515	989	
14	543	1042	
15	571	1095	
16	598	1148	
17	626	1201	
18	654	1254	
19	682	1306	
M200A1 POD			
0	139	277	285
1	167	330	340
2	195	383	394
3	223	436	449
4	251	489	503
5	279	542	558
6	306	595	612
7	334	647	667
8	362	700	721
9	390	753	776
10	418	806	830
11	446	859	885
12	474	912	939
13	502	964	
14	530	1017	
15	558	1070	
16	585	1123	
17	613	1176	
18	641	1229	
19	669	1281	

ROCKETS @ 27.9 LBS. EACH

P **Figure 6-5.1. Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 3 of 18)**

M229 WARHEAD/M429 FUSE
(17 POUND WARHEAD WITH PROXIMITY FUSE)

M159C POD* *S/N 004041 & SUB			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	311
1	180	356	366
2	208	409	421
3	237	462	476
4	265	516	531
5	293	569	586
6	321	622	641
7	349	676	696
8	378	729	751
9	406	782	806
10	434	835	861
11	462	889	916
12	490	942	971
13	519	995	
14	547	1049	
15	575	1102	
16	603	1155	
17	631	1209	
18	660	1262	
19	688	1315	
M200A1 POD			
0	139	277	285
1	167	331	340
2	195	384	395
3	224	437	450
4	252	491	505
5	280	544	560
6	308	597	615
7	336	651	670
8	365	704	725
9	393	757	780
10	421	801	835
11	449	864	890
12	477	917	945
13	506	970	
14	534	1024	
15	562	1077	
16	590	1130	
17	618	1184	
18	647	1237	
19	675	1290	

ROCKETS @ 28.2 LBS. EACH

P **Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 4 of 18)**

WDU-4A/A (FLECHETTE) WARHEAD
(9.3 POUND WARHEAD WITH PROXIMITY FUSE)

M159C POD* *S/N 004041 & SUB			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	152	302	311
1	172	342	352
2	192	381	393
3	213	421	433
4	233	460	474
5	253	500	515
6	273	539	555
7	293	578	596
8	314	618	636
9	334	657	677
10	354	697	718
11	374	736	758
12	394	776	799
13	415	815	
14	435	855	
15	455	894	
16	475	933	
17	495	973	
18	516	1012	
19	536	1052	
M200A1 POD			
0	139	277	285
1	159	317	326
2	179	356	366
3	200	395	407
4	220	435	448
5	240	475	488
6	260	515	529
7	280	554	570
8	301	593	610
9	321	633	651
10	341	673	692
11	361	713	732
12	381	752	773
13	402	792	
14	422	831	
15	442	871	
16	462	910	
17	482	950	
18	503	990	
19	523	1029	

ROCKETS @ 20.2 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 5 of 18)

M151 WARHEAD/M423 FUSE

M157A POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Momemt/100	Outboard Moment/100
0	57	113	116
1	78	152	157
2	98	191	197
3	119	230	237
4	139	269	278
5	160	308	318
6	180	347	358
7	201	386	398
M157B POD			
0	67	134	138
1	88	174	179
2	108	214	221
3	129	254	262
4	149	294	303
5	170	334	345
6	190	374	386
7	211	414	427

ROCKETS @ 20.5 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 6 of 18)

M151 WARHEAD/M423 FUSE

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Momemt/100	Outboard Moment/100
M158 POD			
0	42	83	85
1	62	122	126
2	83	162	167
3	103	202	208
4	124	241	249
5	144	281	290
6	165	320	330
7	185	360	371
M158A-1 POD			
0	48	95	98
1	69	136	140
2	89	176	181
3	110	216	223
4	130	256	264
5	151	296	305
6	171	336	347
7	192	376	388

ROCKETS @ 20.5 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 7 of 18)

M151 WARHEAD/M423 FUSE

M159B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	118	234	241
1	139	273	281
2	159	312	321
3	180	351	362
4	200	390	402
5	221	429	442
6	241	468	483
7	262	507	523
8	282	546	563
9	303	585	603
10	323	624	644
11	344	663	684
12	364	702	724
13	385	741	
14	405	780	
15	426	819	
16	446	858	
17	467	897	
18	487	936	
19	508	975	
M159C POD * *PRIOR TO S/N 004040			
0	130	259	267
1	151	299	309
2	171	340	350
3	192	380	391
4	212	420	433
5	233	460	474
6	253	500	515
7	274	540	556
8	294	580	598
9	315	620	639
10	335	660	680
11	356	700	722
12	376	741	763
13	397	781	
14	417	821	
15	438	861	
16	458	901	
17	479	941	
18	499	981	
19	520	1021	

ROCKETS @ 20.5 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 8 of 18)

M151 WARHEAD/M429 FUSE

M157A POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	57	113	116
1	78	152	157
2	99	192	198
3	119	231	239
4	140	271	280
5	161	311	320
6	182	350	361
7	203	390	402
M157B POD			
0	67	134	138
1	88	174	180
2	109	215	222
3	129	255	263
4	150	296	305
5	171	337	347
6	192	377	389
7	213	418	431

ROCKETS @20.8 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 9 of 18)

M158 POD

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	42	83	85
1	62	123	127
2	83	163	168
3	104	203	209
4	125	243	251
5	146	283	292
6	166	323	333
7	187	363	375

M158A-1 POD

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	Inboard Moment/100	Outboard Moment/100
0	48	95	98
1	69	136	140
2	90	177	182
3	110	217	224
4	131	258	266
5	152	298	308
6	173	339	350
7	194	380	292

ROCKETS @20.8 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 10 of 18)

M151 WARHEAD/M429 FUSE

M159B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	118	234	241
1	139	273	282
2	160	313	322
3	180	352	363
4	201	392	404
5	222	431	445
6	243	471	486
7	264	510	526
8	284	550	567
9	305	589	608
10	326	629	649
11	347	668	689
12	368	708	730
13	388	748	
14	409	787	
15	430	827	
16	451	866	
17	472	906	
18	492	945	
19	513	985	
		M159C POD*	*PRIOR TO S/N 004040
0	130	259	267
1	151	300	309
2	172	341	351
3	192	381	393
4	213	422	435
5	234	462	476
6	255	503	518
7	276	544	560
8	296	584	602
9	317	625	644
10	338	665	686
11	359	706	727
12	380	747	769
13	400	787	
14	421	828	
15	442	868	
16	463	909	
17	484	950	
18	504	990	
19	525	1031	

ROCKETS @ 20.8 LBS. EACH

P **Figure 6-5.1** **Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 11 of 18)**

M229 WARHEAD/M423 FUSE

M157B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	67	134	138
1	95	187	192
2	123	239	247
3	151	292	301
4	179	345	356
5	207	398	411
6	234	451	465
7	262	504	520
M159C POD* *PRIOR TO S/N 004040			
0	130	259	267
1	158	312	322
2	186	365	376
3	214	418	431
4	242	471	485
5	270	524	540
6	297	576	594
7	325	629	649
8	353	682	703
9	381	735	757
10	409	788	812
11	437	841	866
12	465	893	921
13	493	946	
14	521	999	

ROCKETS @ 27.9 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 12 of 18)

M229 WARHEAD/M423 FUSE

M158 POD

Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	42	83	85
1	70	135	139
2	97	187	193
3	125	239	247
4	153	291	301
5	181	343	354
6	209	395	408
7	237	447	462
M158A-1 POD			
0	48	95	98
1	76	148	153
2	104	201	208
3	132	254	262
4	160	307	317
5	188	360	371
6	215	413	426
7	243	465	480

ROCKETS @ 27.9 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 13 of 18)

M229 WARHEAD/M429 FUSE

M157B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	67	134	138
1	95	187	193
2	123	240	248
3	152	294	303
4	180	347	358
5	208	400	413
6	236	453	468
7	264	507	523
M159C POD* *PRIOR TO S/N 004040			
0	130	259	267
1	158	313	322
2	186	366	377
3	215	419	432
4	243	473	487
5	271	526	542
6	299	579	597
7	327	632	652
8	356	686	707
9	384	739	762
10	412	792	817
11	440	846	872
12	468	899	927
13	497	952	
14	525	1006	

ROCKETS @ 28.2 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 14 of 18)

M229 WARHEAD/M429 FUSE

M158 POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	42	83	85
1	70	135	140
2	98	188	194
3	126	241	248
4	154	293	303
5	183	346	357
6	211	398	429
7	239	451	465
M158A-1 POD			
0	48	95	98
1	76	149	153
2	104	202	209
3	133	255	264
4	161	309	319
5	189	362	374
6	217	415	479
7	245	469	484

ROCKETS @ 28.2 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 15 of 18)

WDU-4A/A (FLECHETTE) WARHEAD

M157A POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	57	113	116
1	77	151	156
2	97	190	196
3	118	228	235
4	138	266	275
5	158	305	315
6	178	343	354
7	198	382	394
M157B POD			
0	67	134	138
1	87	173	179
2	107	213	219
3	128	252	260
4	148	291	301
5	168	331	341
6	188	370	382
7	208	410	423

ROCKETS @20.2 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 16 of 18)

WDU-4A/A (FLECHETTE) WARHEAD

M158 POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	42	83	85
1	62	122	126
2	82	161	166
3	102	200	206
4	122	238	246
5	143	277	286
6	163	316	326
7	183	355	366
M158A-1 POD			
0	48	95	98
1	68	135	139
2	88	174	180
3	109	214	220
4	129	253	261
5	149	293	302
6	169	332	343
7	189	371	383

ROCKETS @ 20.2 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 17 of 18)

WDU-4A/A (FLECHETTE) WARHEAD

M159B POD			
Rockets (Number)	Weight (Pounds) Pod & No. of Rockets Indicated	LOCATION ON WING	
		Inboard Moment/100	Outboard Moment/100
0	118	234	241
1	138	272	281
2	158	311	320
3	179	349	360
4	199	387	399
5	219	426	439
6	239	464	479
7	259	502	518
8	280	541	558
9	300	579	597
10	320	618	637
11	340	656	676
12	360	694	716
13	381	733	
14	401	771	
15	421	809	
16	441	848	
17	461	886	
18	482	925	
19	502	963	
M159C* POD		*PRIOR TO S/N 004040	
0	130	259	267
1	150	299	308
2	170	338	349
3	191	378	389
4	211	417	430
5	231	457	470
6	251	496	511
7	271	535	552
8	292	575	592
9	312	614	633
10	332	654	674
11	352	693	714
12	372	733	755
13	393	772	
14	413	811	
15	433	851	
16	453	890	
17	473	930	
18	494	969	
19	514	1009	

ROCKETS @20.2 LBS. EACH

P Figure 6-5.1 Folding Fin Aerial Rocket (2.75 Inch) Moment Table (Sheet 18 of 18)

7.62 MM (LINKLESS) FOR M18		
Rounds (Number)	Weight (lbs) Pod No. of Rounds Indicated	Inboard Wing Position (only) Moment/100
0	245	481
100	251	492
200	256	503
300	262	514
400	267	526
500	273	537
600	278	548
700	284	559
800	289	570
900	295	581
1000	300	592
1100	306	603
1200	311	615
1300	317	626
1400	322	637
1500	328	648

7.62MM AMMO (LINKLESS) @
0.055 LBS. EACH

20MM LINKED		
Rounds (Number)	Weight (lbs) For No. of Rounds Indicated	Moment/100
		F.S. 113.0
50	34	38
100	67	76
150	101	114
200	134	151
250	168	190
300	201	227
350	235	266
400	268	303
450	302	341
500	335	379
550	369	417
600	402	454
650	436	493
700	469	530
750	503	568

20MM AMMO (LINKED) @
0.67 LBS. EACH

209900-774-2B

M **E** Figure 6-6. Ammunition Moment Table

7.62 MM (LINKED) FOR M134		
Rounds (Number)	Weight (lbs) For No. of Rounds Indicated	Moment/100
250	16	21
500	33	42
750	49	63
1000	65	83
1250	81	103
1500	98	123
1750	114	142
2000	130	161
2250	146	179
2500	163	197
2750	179	215
3000	195	232
3250	211	250
3500	228	266
3750	244	283
4000	260	295

7.62MM AMMO (LINKED) @
0.065 LBS. EACH

40MM GRENADES FOR M129		
Rounds (Number)	Weight (lbs) For No. of Rounds Indicated	Moment/100
25	19	21
50	38	43
75	57	64
100	76	86
125	95	107
150	114	129
175	133	150
200	152	172
225	171	193
250	190	215

GRENADES @ 0.76 LBS. EACH

7.62 MM (LINKLESS) FOR M18		
Rounds (Number)	Weight (lbs) Pod No. of Rounds Indicated	Inboard Wing Position (only) Moment/100
0	245	481
100	251	492
200	256	503
300	262	514
400	267	526
500	273	537
600	278	548
700	284	559
800	289	570
900	295	581
1000	300	592
1100	306	603
1200	311	615
1300	317	626
1400	322	637
1500	328	648

7.62MM AMMO (LINKLESS) @
0.055 LBS. EACH

P Figure 6-6.1 Ammunition Moment Table

BGM-71 OR BTM-71A TOW MISSILE

ITEM	WEIGHT (POUNDS)	OUTBOAPD WING POSITION ONLY	
		UPPER LAUNCHER MOMENT/100	LOWER LAUNCHER MOMENT/100
(1) Launcher	60	123	122
(2) Launchers	120	246	244
(1) Tube	13	26	26
(2) Tubes	26	52	52
(3) Tubes	39	78	78
(4) Tubes	52	104	103
(1) Missile	41	82	82
(2) Missiles	82	164	163
(3) Missiles	123	246	245
(4) Missiles	164	328	326

209900-828

Figure 6-7. TOW Missile Moment Chart

SECTION V. CARGO LOADING

(Not Applicable)

SECTION VI. FUEL/OIL

6-9. FUEL DATA.

Refer to figure 6-8 for fuel quantity, weight, and moment.

6-10. OIL DATA.

For weight and balance purposes, oil is considered a part of aircraft basic weight.

FUEL MOMENT

FUEL MOMENT
AH-1S

EXAMPLE

WANTED

MOMENT FOR KNOWN FUEL QUANTITY AND AMOUNT OF JP-4 FUEL IN GALLONS

KNOWN

FUEL QUANTITY = 1200 LB OF JP-4

METHOD

ENTER FUEL WEIGHT SCALE HERE
MOVE RIGHT TO INTERSECT JP-4 LINE
INTERPOLATE FOR FUEL QUANTITY
IN GALLONS.
READ FUEL = 184.5 GAL OF JP-4
MOVE DOWN.
READ MOMENTS = 2,440 LBS

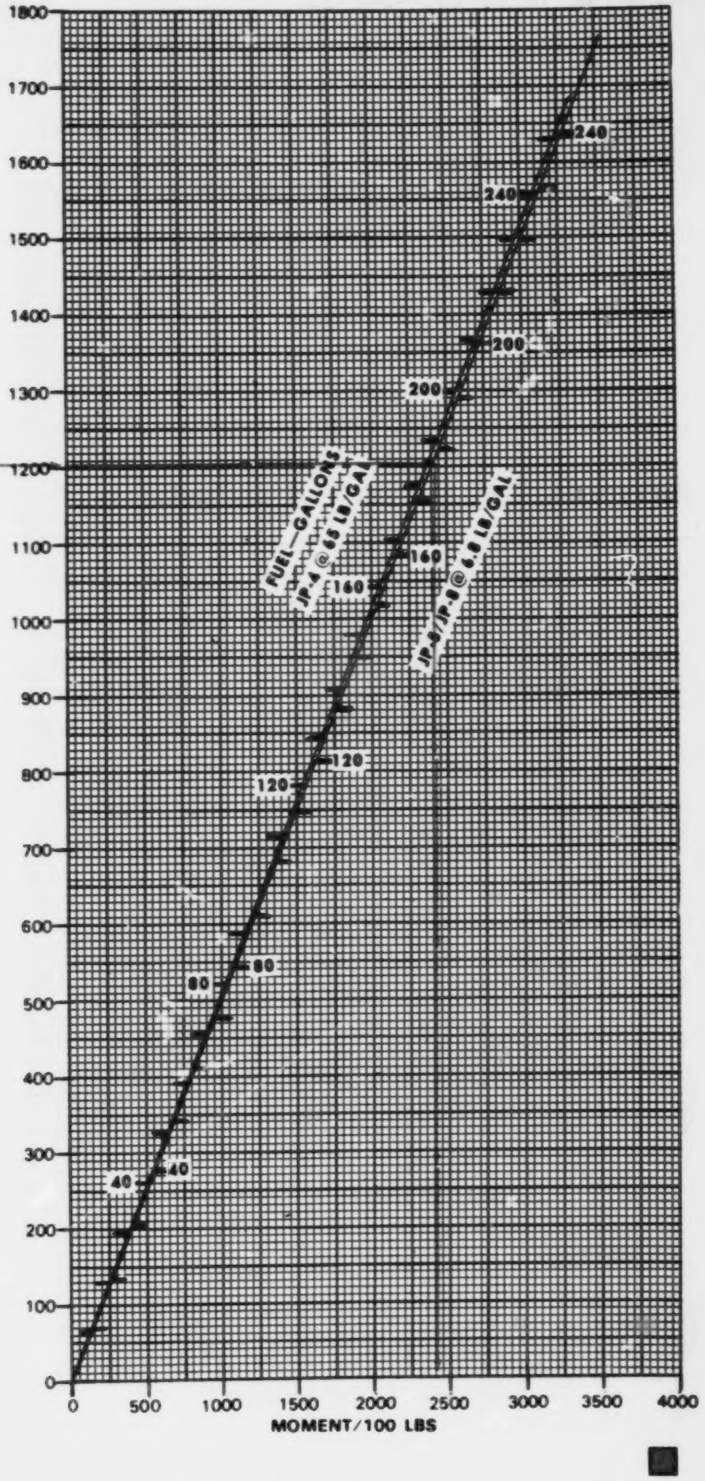


Figure 6-8. Fuel Moment Chart

SECTION VII. ALLOWABLE LOADING

Refer to TM 55-1500-342-23.

Paragraphs 6-11 through 6-14 are deleted.

EXAMPLE

WANTED

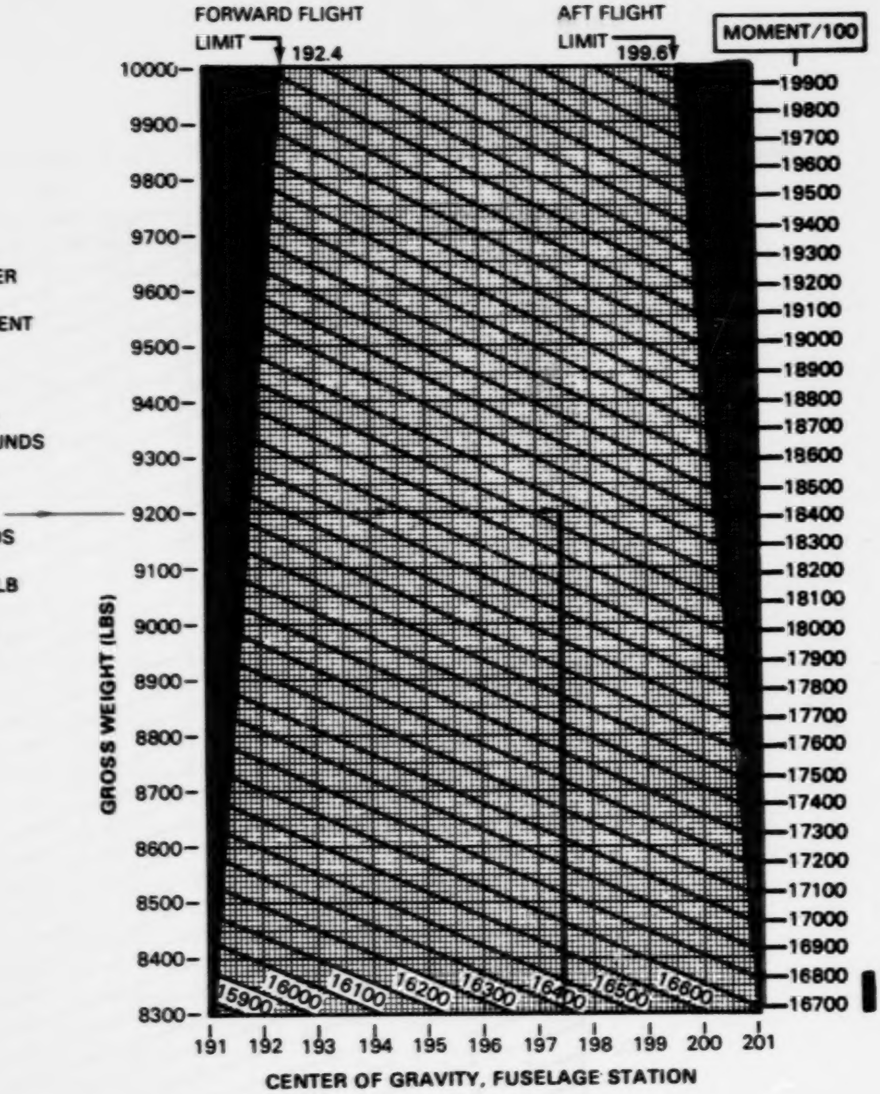
DETERMINE APPROXIMATE CENTER OF GRAVITY FOR KNOWN WEIGHT AND MOMENT

KNOWN

GROSS WEIGHT = 9200 POUNDS
MOMENT/100 = 18150 INCH-POUNDS

METHOD

MOVE RIGHT FROM 9200 POUNDS TO APPROXIMATE MIDPOINT BETWEEN 18100 AND 18200 IN-LB DIAGONAL LINES.
FROM THIS POINT MOVE DOWN TO READ 197.4 ON CENTER OF GRAVITY SCALE.



209900-489-1G

Figure 6-9. Center of Gravity Limits Chart (Sheet 1 of 2)

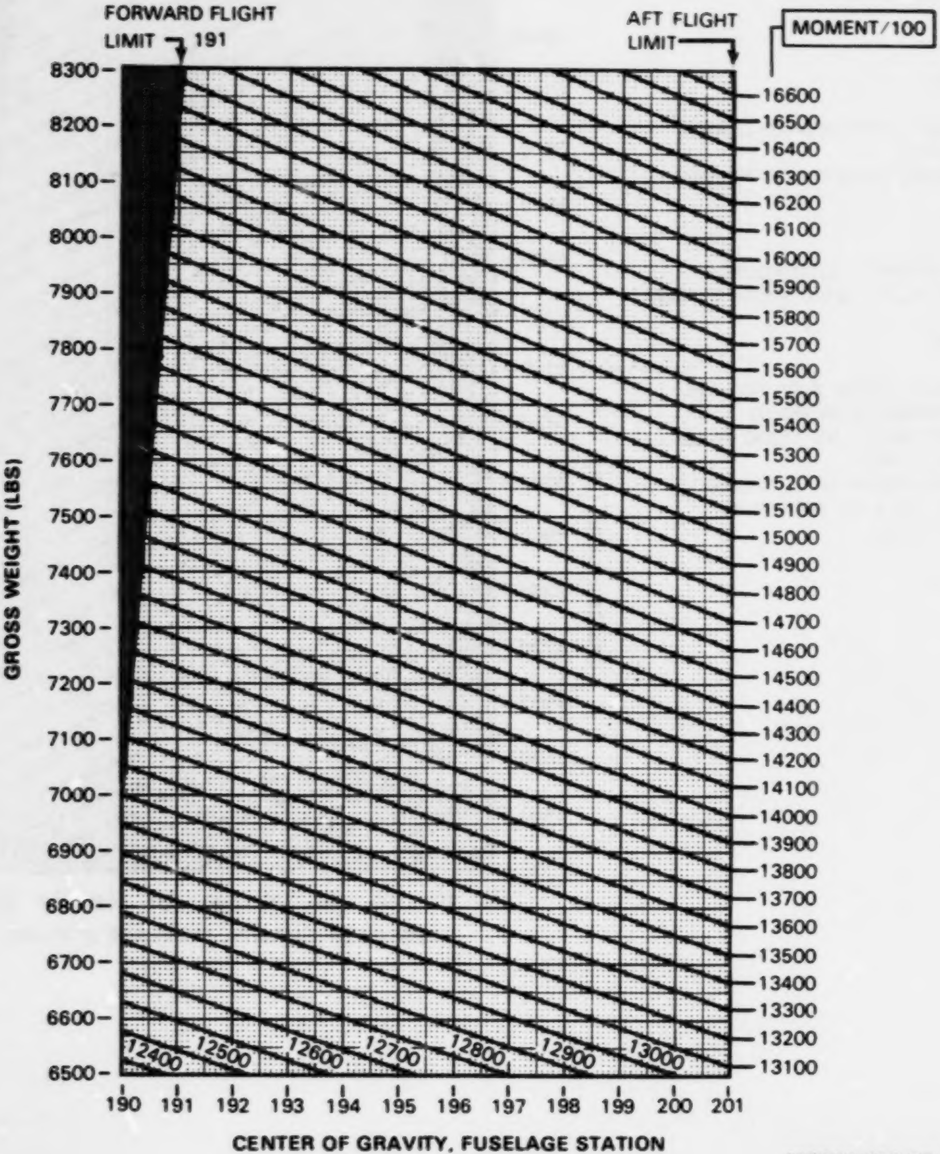


Figure 6-9. Center of Gravity Limits Chart (Sheet 2 of 2)

All data on pages 6-19 through 6-22, including figures 6-11 and 6-12 is deleted.

Chapter 6.1 on pages 6.1-1 through 6.1-31 is deleted.

CHAPTER 7

PERFORMANCE DATA

SECTION I. INTRODUCTION

NOTE

Chapter 7.1 provides information for the AH-1P/E/F equipped with K747 main rotor blade. Chapter 7 provides information for the AH-1P/E/F equipped with B540 main rotor blade.

7-1. PURPOSE.

The purpose of this chapter is to provide the best available performance data for the AH-1P/E/F helicopter. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons.

a. Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

b. Situations requiring maximum performance will be more readily recognized.

c. Familiarity with the data will allow performance to be computed more easily and quickly.

d. Experience will be gained in accurately estimating the effects of variables for which data are not presented.

NOTE

The information provided in this chapter is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used inflight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-2. CHAPTER 7 INDEX.

The following index contains a list of the sections and their titles, the figure numbers, subjects and page numbers of each performance data chart contained in this chapter.

INDEX

SECTION — SUBJECT — PAGE NO.

I INTRODUCTION 7-1

II PERFORMANCE PLANNING 7-5

Figure 7-1 Deleted
Figure 7-2 Temperature Conversion Chart 7-9

III TORQUE AVAILABLE 7-10

Figure 7-3 Maximum Torque Available (30-Minute Operation) Chart
Engine Deice — Off and ECS Off 7-11
Figure 7-4 Torque Available (Continuous Operation) Chart
Sheet 1 of 2 Engine Deice — Off and ECS Off 7-12
Sheet 2 Off and ECS On 7-13

INDEX (Cont)

SECTION	SUBJECT	PAGE NO.
IV	HOVER	7-14
	Figure 7-5 Hover Chart	
	Sheet 1 of 2 Hover Ceiling	7-15
	Sheet 2 Hover Chart	7-17
	Figure 7-5.1. Directional Control Margin Chart	7-18.1
V	TAKEOFF	7-18
	Figure 7-6 Takeoff Chart	7-19
VI	CRUISE	7-20
	Figure 7-7 Cruise Chart	
	Sheet 1 of 23 FAT = -30°C, Pressure Altitude = Sea Level	7-21
	Sheet 2 2000 Ft	7-22
	Sheet 3 4000 Ft to 6000 Ft	7-23
	Sheet 4 8000 Ft to 10000 Ft	7-24
	Sheet 5 12000 Ft to 14000 Ft	7-25
	Sheet 6 -15°C, Sea Level to 2000 Ft	7-26
	Sheet 7 4000 Ft to 6000 Ft	7-27
	Sheet 8 8000 Ft to 10000 Ft	7-28
	Sheet 9 12000 Ft to 14000 Ft	7-29
	Sheet 10 0°C, Sea Level to 2000 Ft	7-30
	Sheet 11 4000 Ft to 6000 Ft	7-31
	Sheet 12 8000 Ft to 10000 Ft	7-32
	Sheet 13 12000 Ft to 14000 Ft	7-33
	Sheet 14 +15°C, Sea Level to 2000 Ft	7-34
	Sheet 15 4000 Ft to 6000 Ft	7-35
	Sheet 16 8000 Ft to 10000 Ft	7-36
	Sheet 17 12000 Ft to 14000 Ft	7-37
	Sheet 18 +30°C, Sea Level to 2000 Ft	7-38
	Sheet 19 4000 Ft to 6000 Ft	7-39
	Sheet 20 8000 Ft to 10000 Ft	7-40
	Sheet 21 +45°C, Sea Level to 2000 Ft	7-41
	Sheet 22 4000 Ft to 6000 Ft	7-42
	Sheet 23 8000 to 10000 Ft	7-43
VII	DRAG	7-44
	Figure 7-8 Drag Chart	7-45
VIII	CLIMB-DESCENT	7-46
	Figure 7-9 Climb-Descent Chart	7-47
	Figure 7-10 Climb Performance Chart	7-49
IX	IDLE FUEL FLOW	7-50
	Figure 7-11 Idle Fuel Flow Chart	7-51

7-3. GENERAL.

The data presented covers the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data are presented at conservative conditions. However, NO GENERAL CONSERVATISM HAS BEEN APPLIED. All performance data presented are within the applicable limits of the aircraft.

7-4. LIMITS.

Applicable limits are shown on the charts as red lines. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. USE OF CHARTS.

a. Chart Explanation. The first page of each section describes the chart(s) and explains its uses.

b. Color Coding. Chart color codes are used as follows.

(1) Green is used for example guidelines.

(2) Red is used for limit lines.

(3) Yellow is used for precautionary or time-limited operation.

c. Reading the Charts. The primary use of each chart is given in a example and a green guideline is provided to help up follow the route through the chart. The use of a straight edge (ruler or page edge) and a hard fine point pencil is recommended to avoid cumulative errors. The majority of the charts provide a standard pattern for use as follows: enter first variable on top left scale, move right to the second variable, reflect down at right angles to the third variable, reflect left at right angles to the fourth variable, reflect down, etc. until the final variable is read out at the final scale. In addition to the primary use, other uses of each chart are explained in the text accompanying each set of performance charts. Colored registration blocks located at the bottom and top of each chart are used to determine if slippage has occurred during printing. If slippage has occurred, refer to Chapter 5 for correct operating limits.

NOTE

An example of an auxiliary use of the charts referenced above is as follows: Although the hover chart is primarily arranged to find torque required to hover, by entering torque available as torque required, maximum skid height for hover can also be found. In general, any single variable can be found if all others are known. Also, the tradeoffs between two variables can be found. For example, at a given pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

7-6. DATA BASIS.

The type of data used is indicated at the bottom of each performance chart under DATA BASIS. The data provided generally is based on one of four categories:

a. Flight Test Data. Data obtained by flight test of the aircraft by experienced flight test personnel at precise conditions using sensitive calibrated instruments.

b. Derived From Flight Test. Flight test data obtained on a similar rather than the same aircraft and series. Generally small corrections will have been made.

c. Calculated Data. Data bases on tests, but not on flight test of the complete aircraft.

d. Estimated Data. Data based on estimates having aerodynamic theory or other means but not verified by flight test.

7-7. SPECIFIC CONDITIONS.

The data presented are accurate only for specific conditions listed under the title of each chart. Variables for which data are not presented, but which may affect that phase of performance, are discussed in the text. Where data are available or reasonable estimates can be made, the amount that each variable affects performance will be given.

7-8. GENERAL CONDITIONS.

In addition to the specific conditions, the following general conditions are applicable to the performance data.

a. Rigging. All airframe and engine control are assumed to be rigged within allowable tolerances.

b. Pilot Technique. Normal pilot technique is assumed. Control movements should be smooth and continuous.

c. Aircraft Variation. Variations in performance between individual aircraft are known to exist; however, they are considered to be small and cannot be individually accounted for.

d. Instrument Variation. The data shown in the performance charts do not account for instrument inaccuracies or malfunctions.

7-9. PERFORMANCE DISCREPANCIES.

Regular use of this chapter will allow you to monitor instruments and other aircraft systems for malfunction, by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data are not provided, thereby increasing the accuracy of performance predictions.

7-10. DEFINITIONS OF ABBREVIATIONS.

a. Unless otherwise indicated in Appendix B, abbreviations and symbols used in this manual conform to those established in Military Standard MIL-STD-12, which is periodically revised to reflect current changes in abbreviations usage. Accordingly, it may be noted that certain previously established definitions have been replaced by more current abbreviations and symbols.

b. Capitalization and punctuation of abbreviations varies, depending upon the context in which they are used. In general, lower case abbreviations are used in text material, whereas abbreviations used in charts and illustrations appear in full capital letters. Periods do not usually follow abbreviations; however, periods are used with abbreviations that could be mistaken for whole words if the period were omitted.

SECTION II. PERFORMANCE PLANNING

7-11. PERFORMANCE PLANNING.

Refer to FC1-213 Aircrew Training Manual for preparing the performance planning card (PPC).

7-12. TEMPERATURE CONVERSION.

The temperature conversion chart (figure 7-2) is arranged so that degrees celsius can be converted quickly and easily by reading celsius and looking directly across the chart for fahrenheit equivalent and vice versa.

All data on pages 7-6 thru 7-7/7-8, including figure 7-1 and paragraph 7-13 is deleted.

TEMPERATURE CONVERSION CHART

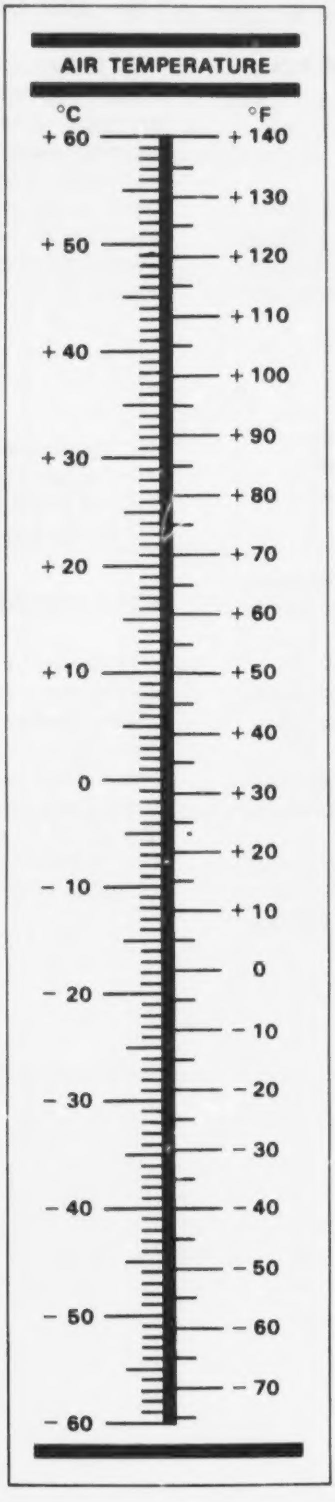


Figure 7-2. Temperature conversion chart

SECTION III. TORQUE AVAILABLE

7-14. DESCRIPTION.

The torque available charts show the effects of altitude and temperature on engine torque.

7-15. CHART DIFFERENCES.

Both pressure altitude and FAT affect engine power production. Figures 7-3 and 7-4 show power available data at 30 minute power and maximum continuous power ratings in terms of the allowable torque as recorded by the torquemeter (%Q).

CAUTION

The power output capability of the T53-L-703 engine can exceed the transmission structural limit (100% Q) under certain conditions.

a. Figure 7-3 (sheet 1) is applicable for maximum power, engine deice off and ECS off, 30 minute operation.

b. Figure 7-4 (sheet 1) is applicable for maximum continuous power, engine deice off, and ECS off.

c. Figure 7-4 (sheet 2) is applicable for maximum continuous power, engine deice off and ECS on.

d. Prolonged IGE hover may increase engine inlet temperature as much as 10 degrees Celsius, therefore, a higher FAT must be used to correct for the increase under this condition.

7-16. USE OF CHARTS.

The primary use of the charts is illustrated by the examples. In general, to determine the maximum power available, it is necessary to know the pressure altitude and temperature. The calibration factor (Data Plate Torque), obtained from the engine data plate or from the engine acceptance records, is the indicated torque pressure at the actual output shaft torque, and is used to correct the error of individual engine torque indicating system.

NOTE

Torque available data shown in figures 7-3, 7-4, and 7-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7-1.

7-17. CONDITIONS.

Charts (figure 7-3 and 7-4) are based upon speeds at 100 percent rpm with grade JP-4 fuel. The use of aviation gasoline will not influence engine power. Fuel grade of JP-5 will yield the same nautical miles per pound of fuel and being 6.8 pounds per gallon will only result in increased fuel weight per gallon. Because JP-4 and JP-5 have the same energy value per pound, then JP-5 fuel will increase range by almost 5 percent per gallon of fuel.

Interim Table 7-1. Performance Data Correction Information

As an interim measure, this table is provided until such time as performance charts can be corrected.

With the IR suppressor installed, the equivalent flat plate drag area will be increased by ½ sq. ft. and fuel flow will be increased by up to 4%.

Hover performance should be determined using sheet 2 of figure 7-5 and climb performance should be determined using figure 7-9. Sheet 1 of figure 7-5 and figure 7-10 are based on the torque available shown in figure 7-3 and do not accurately reflect the hover ceiling and climb capability of the helicopter.

	FAT	Pressure Altitude - Feet							
	°C	0	2000	4000	6000	8000	10000	12000	14000
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	- - -	- - -	5½	5
For Max.	-15	- - -	- - -	- - -	- - -	- - -	6	4½	3
Torque Avail.	0	- - -	- - -	- - -	6	6	5	4½	4
(30 Min.)	15	- - -	6	4½	4	4	3½	4½	6
W/O IR	30	4½	4	3½	4	2½	1½	2½	5½
Suppressor	45	5	3½	4½	5	4½	4	4½	6½
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	- - -	8½	7½	7
For Max.	-15	- - -	- - -	- - -	- - -	9	9	8	7
Torque Avail.	0	- - -	- - -	9½	9½	9½	9	9	8½
(30 Min.)	15	12½	12½	9½	9½	9	8	9	10½
With IR	30	12½	11	10	10	8½	6½	7	9½
Suppressor	45	13	11	11½	11½	10½	9½	9	10
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	4½	4	3	2½
For Cont.	-15	- - -	- - -	- - -	4½	4	4	3½	3½
Torque Avail.	0	5	4½	4	3½	3½	3½	4½	4½
W/O IR	15	4	4	3½	3	3	2½	3	3½
Suppressor	30	4½	4	4	4	2½	½	0	0
	45	4½	4	4	5	4	3½	2½	2
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	9	8	7	6
For Cont.	-15	- - -	- - -	10½	9½	9	8½	8	7½
Torque Avail.	0	12	11	10	9	8½	8½	8½	8½
With IR	15	11½	11	10	9	8½	7½	8	7½
Suppressor	30	11½	10½	10	10	8	5½	4	2
	45	11½	10	10	10	9½	8	6½	5

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ENGINE DEICE OFF, ECS OFF

100% RPM JP-4 FUEL

MAXIMUM TORQUE AH-1S T53-L-703

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

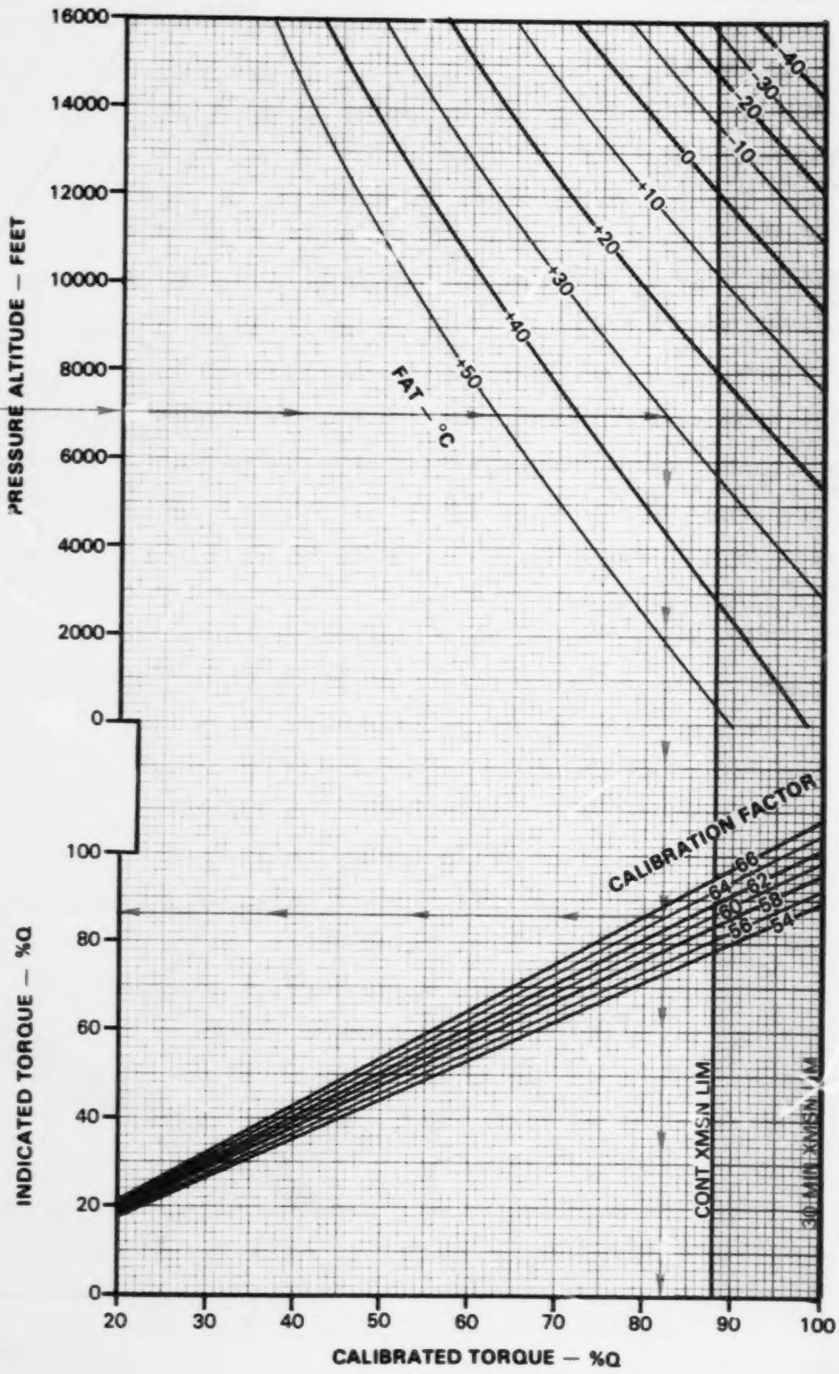
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 30°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED TORQUE = 86.0 %Q

FOR CALIBRATED TORQUE CONTINUE DOWN THRU CALIBRATION FACTOR, READ CALIBRATED TORQUE = 82.2 %Q



DATA BASIS: CALCULATED

Figure 7-3. Maximum torque available (30 minute operation) chart

TORQUE AVAILABLE (CONTINUOUS OPERATION)

ENGINE DEICE OFF, ECS OFF

100% RPM JP-4 FUEL

TORQUE
AVAILABLE
AH-1S
T53-L-703

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

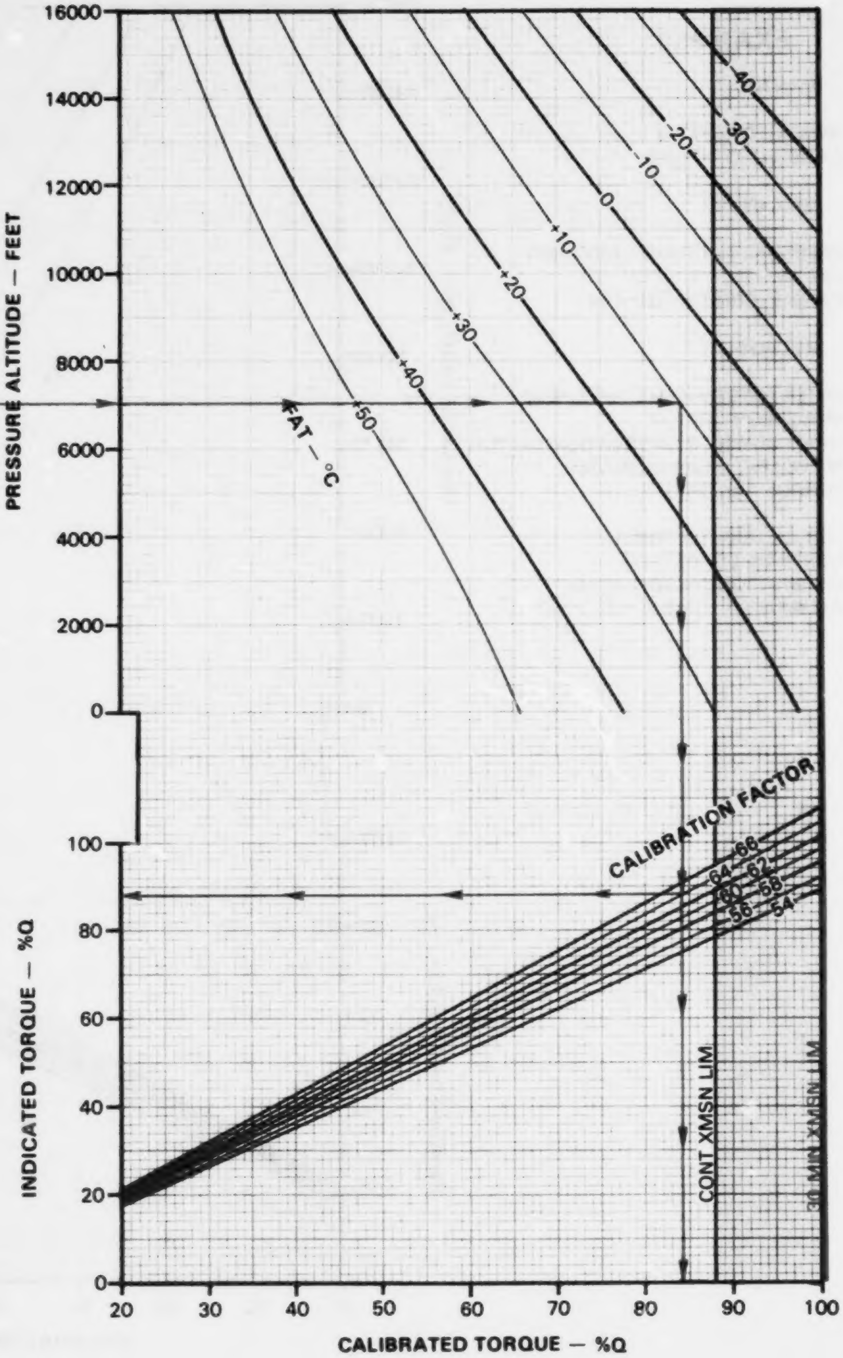
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED
TORQUE = 88.0 % Q

FOR CALIBRATED TORQUE
CONTINUE DOWN THRU
CALIBRATION FACTOR, READ
CALIBRATED TORQUE = 84.2 %Q



DATA BASIS: CALCULATED

Figure 7-4. Torque available (continuous operation) chart (Sheet 1 of 2)

TORQUE AVAILABLE (CONTINUOUS OPERATION)

ENGINE DEICE OFF, ECS ON

100% RPM JP-4 FUEL

TORQUE AVAILABLE
AH-1S
T53-L-703

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

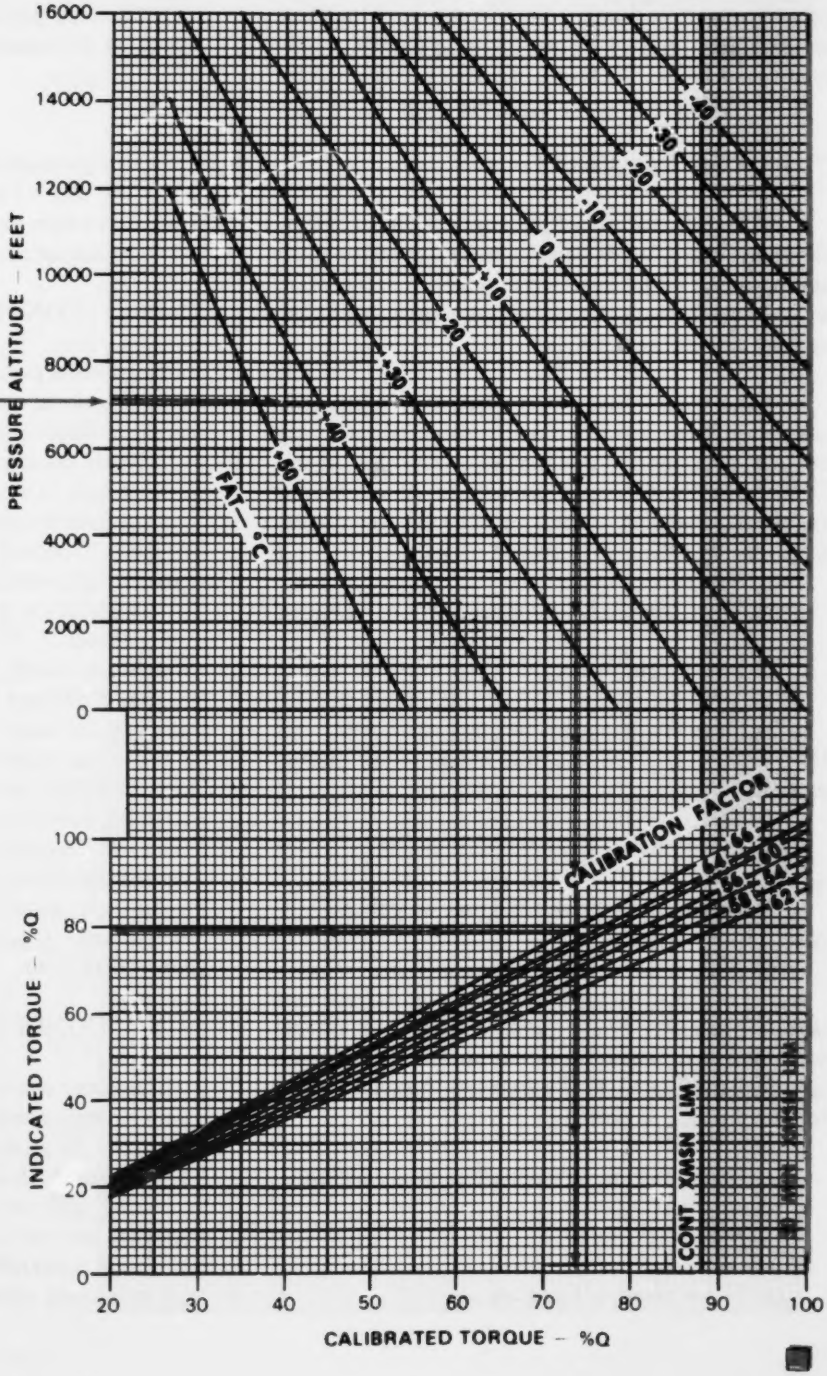
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED
TORQUE = 77.0 % Q

FOR CALIBRATED TORQUE
CONTINUE DOWN THRU
CALIBRATION FACTOR, READ
CALIBRATED TORQUE = 73.8 % Q



DATA BASIS: CALCULATED

Figure 7-4. Torque available (continuous operation) chart (Sheet 2 of 2)

SECTION IV. HOVER

7-18. DESCRIPTION.

The hover charts (figure 7-5, sheets 1 and 2) show the hover ceiling and the torque required to hover respectively at various pressure altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available from figure 7-3.

7-19. USE OF CHART.

a. The primary use of the charts is illustrated by the charts examples. In general, to determine the hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight and the desired skid height.

b. The hover ceiling chart sheet 1 of 2 shows the maximum gross weight at which the helicopter may hover at maximum torque available. The chart shows OGE hover performance with trade-off curves for various skid heights (IGE) operation. To obtain maximum hover capability, proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight (which represents OGE hover), if a specific skid height (IGE) desired proceed.

(4) Move down to desired skid height.

(5) Move left and read IGE gross weight capability at desired skid height.

c. In addition to its primary use, the hover chart (sheet 2) can also be used to determine the predicted maximum hover height, which is needed for use of the takeoff chart (figure 7-6). To determine maximum hover height, proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight.

(4) Move left to intersection with maximum power available (obtained from figure 7-3).

(5) Read predicted maximum skid height. This height is the maximum hover height.

NOTE

Torque available data shown in figures 7-3, 7-4, and 7-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7-1.

7-19.1. CONTROL MARGIN.

Ten percent pedal margin is considered adequate for safe directional control. Figure 7-5.1 (sheet 1) shows the combinations of relative wind velocity and azimuth which may result in marginal directional control. Figure 7-5.1 (sheet 1) shows the maximum right crosswind, in knots true airspeed, which one can achieve and still maintain 10 percent directional control margin for given gross weights and density altitudes. This figure has zone letters which are to be used in conjunction with figure 7-5.1 (sheet 2). If, for example, your operating gross weight and density altitude are such that the point lies in zone C on sheet 1 then go to sheet 2. The zone identified by the letter C shows the wind velocity in knots that one can achieve while still maintaining a 10 percent directional control margin (e.g., if the wind were from 45 degrees you could have 18.5 knots of wind whereas, if from 60 degrees, only 15.4 knots). The left vertical zone lines on sheet 2 represent 10 percent control margin. As you move toward the right for that gross weight and density altitude, the control margin approaches zero.

7-20. CONDITIONS.

The hover charts are based upon calm wind conditions, a level ground surface, and the use of 100 percent rpm. In ground effect hover data is based upon hovering over a level surface. If the surface over which hovering will be conducted is known to be steep, uneven, covered with high vegetation, or if the type of terrain is unknown, the flight should be planned for out of ground effect hover capability.

■G

HOVER CEILING

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

100% RPM

HOVER
CEILING
AH-1S
T53-L-703

EXAMPLE

WANTED

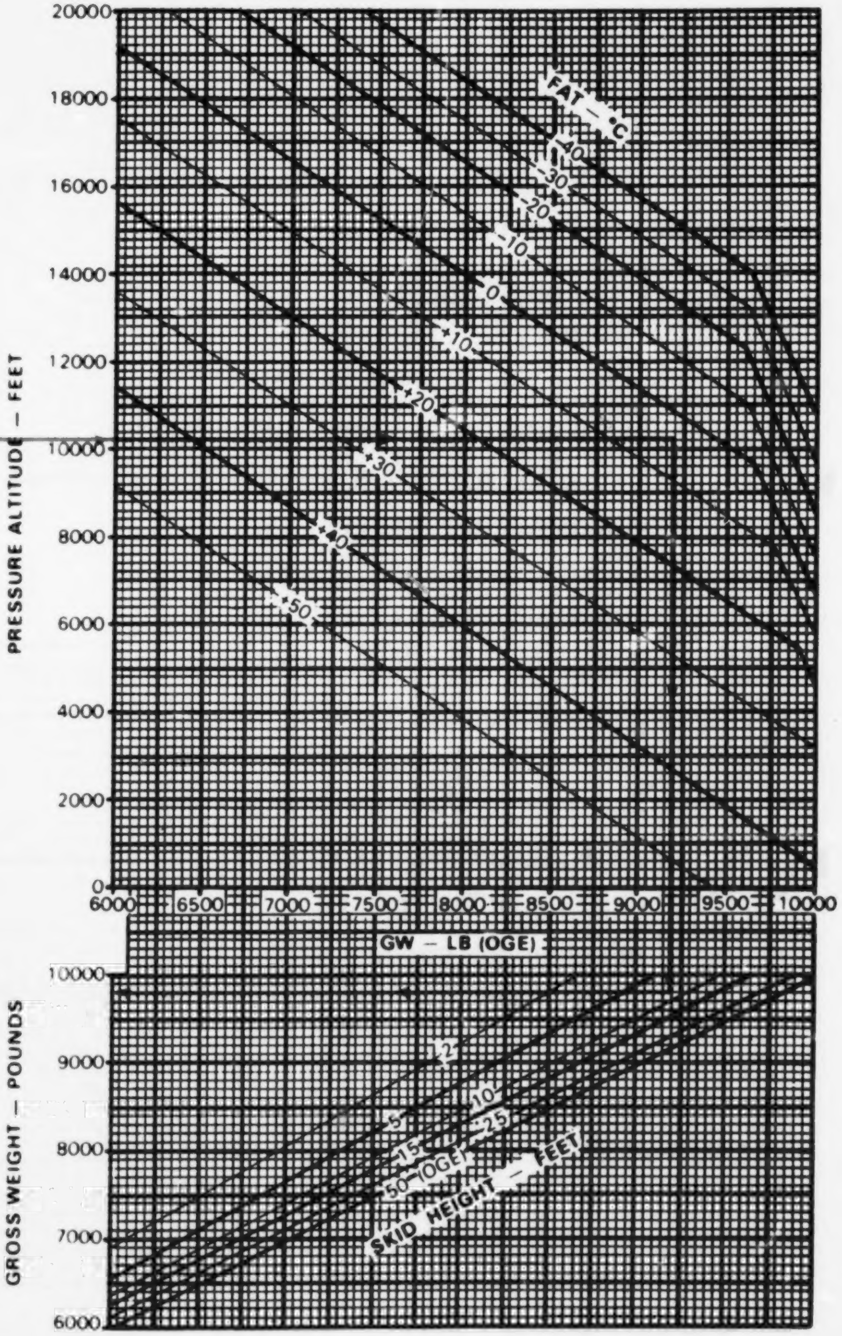
GROSS WEIGHT TO HOVER

KNOWN

PRESSURE ALTITUDE = 10000 FEET
FAT = 0°C
SKID HEIGHT = 10 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO SKID HEIGHT
MOVE LEFT, READ GROSS WEIGHT
TO HOVER = 9700 POUNDS



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 **Figure 7-5. Hover (Ceiling) chart (Sheet 1 of 2)**

EXAMPLE B540

WANTED

MAXIMUM GROSS WEIGHT TO HOVER AT OGE

KNOWN (REFERENCE EXAMPLE FOR FIGURE 7-3)

30 MINUTE CALIBRATED TORQUE AVAILABLE =82% Q

PRESSURE ALTITUDE = 7000 FEET

FAT = +30°C

CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE → ①

MOVE RIGHT AND INTERPOLATE FOR +30°C FAT

MOVE DOWN AND READ DENSITY ALTITUDE = 10000 FEET

ENTER CALIBRATED TORQUE HERE → ②

MOVE UP TO INTERSECT OGE LINE

MOVE RIGHT TO INTERSECT THE VERTICAL

LINE FROM ① AND READ GROSS WEIGHT TO HOVER = 8500 POUNDS

G■
R■
Y☐

HOVER

ALL CONFIGURATIONS 100% RPM
LEVEL SURFACE CALM WIND

HOVER
AH-1S
T53-L-703

EXAMPLE

WANTED

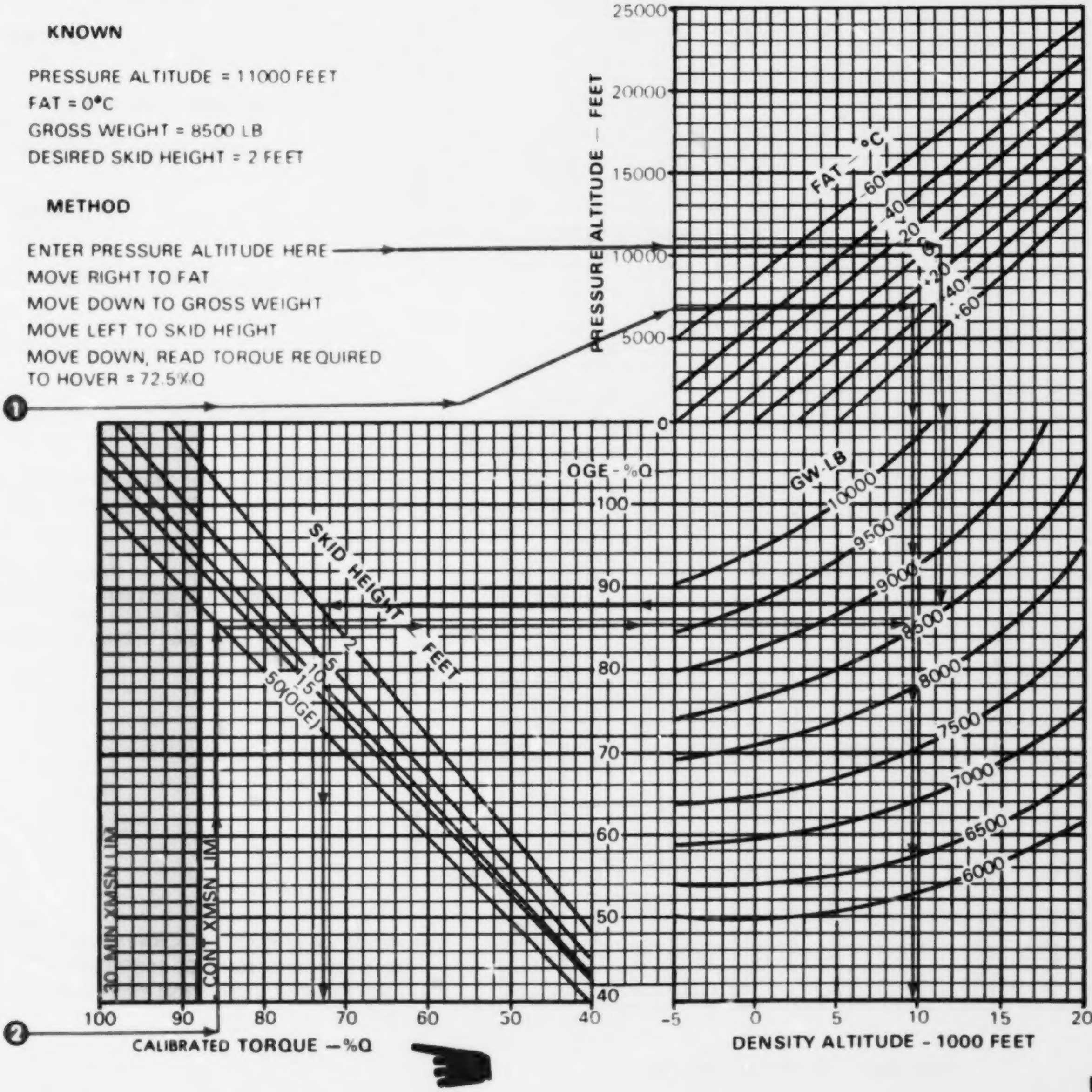
TORQUE REQUIRED TO HOVER

KNOWN

PRESSURE ALTITUDE = 11000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 LB
DESIRED SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT
MOVE LEFT TO SKID HEIGHT
MOVE DOWN, READ TORQUE REQUIRED TO HOVER = 72.5%Q



■G
■R
☐Y

DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-5. Hover chart (Sheet 2 of 2)

All data on page 7-18 is deleted.

DIRECTIONAL CONTROL MARGIN

CONTROL
MARGIN
AH-1S
T53-L-703

EXAMPLE

WANTED

CONDITIONS (AIRSPEED — AZIMUTH) WHERE DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10%

KNOWN

PRESSURE ALTITUDE = 5000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 POUNDS

METHOD

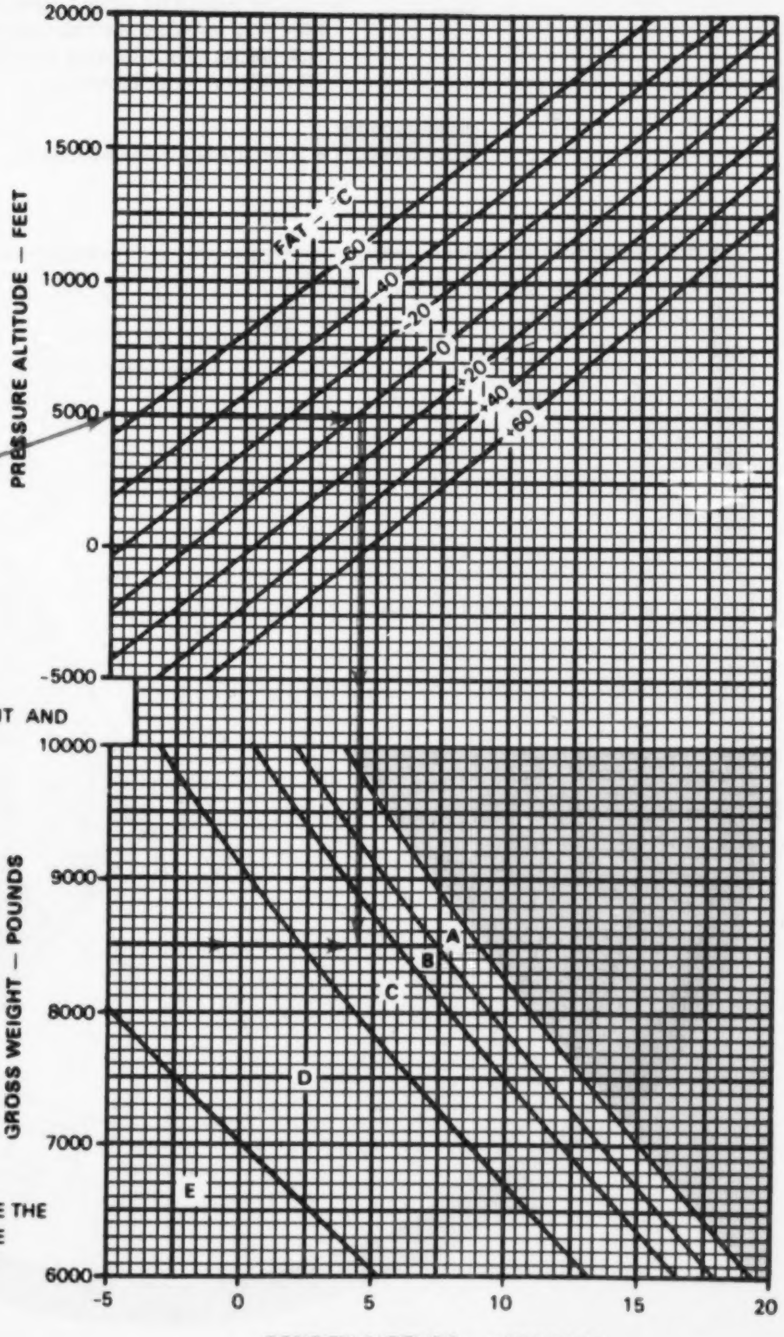
ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN TO KNOWN GROSS WEIGHT

DETERMINE INTERSECTION OF GROSS WEIGHT AND DENSITY ALTITUDE LINES IS IN AREA C

REFER TO SHEET 2
DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10% FOR THE CONDITIONS (AIRSPEED & AZIMUTH)



☐ YELLOW INDICATES CONDITIONS WHERE THE DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10% IN ZERO WIND HOVER

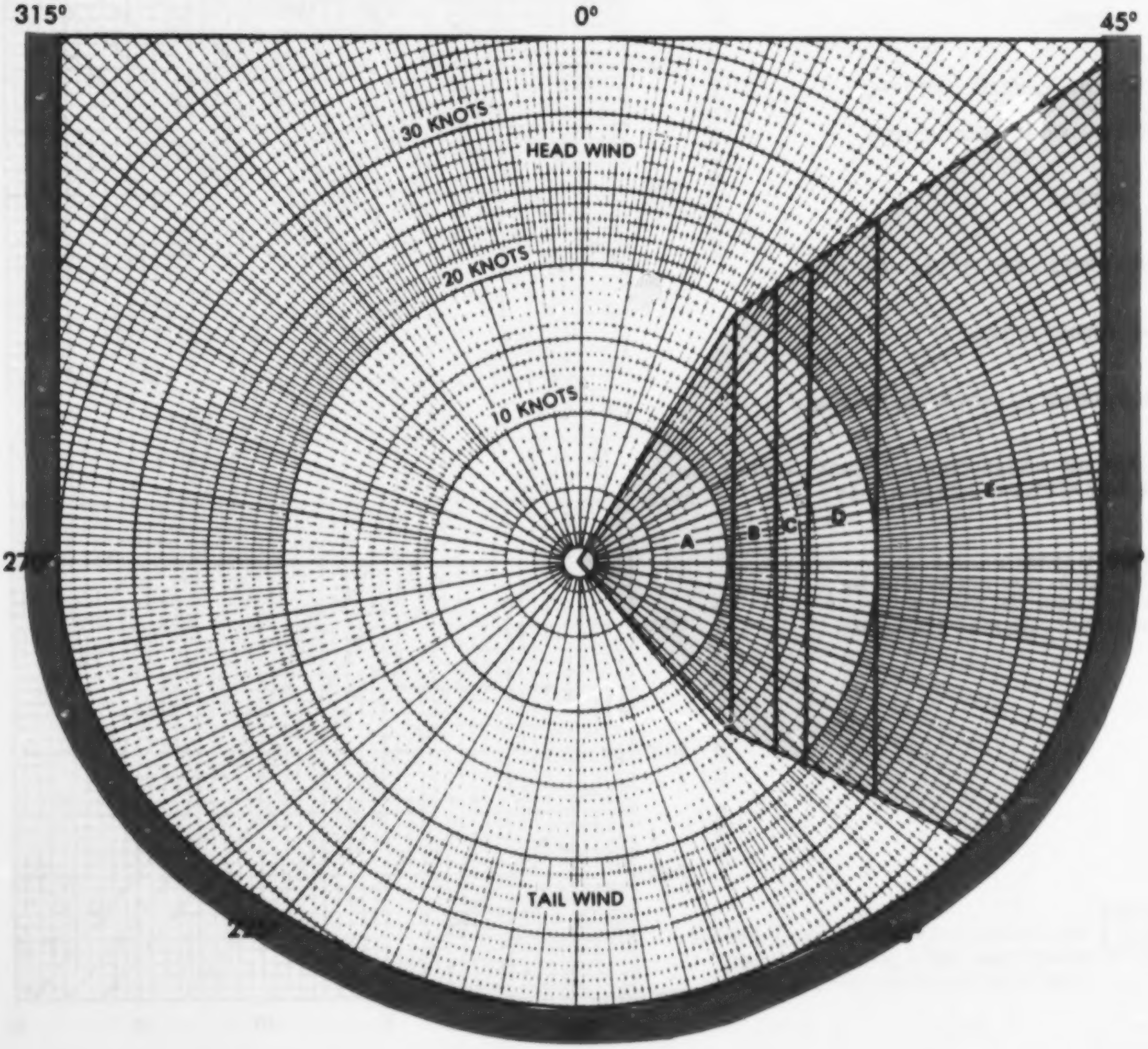
DATA BASIS: DERIVED FROM FLIGHT TEST

Figure 7-5.1 Directional Control Margin Chart (Sheet 1 of 2)

DIRECTIONAL CONTROL MARGIN

🟨 YELLOW INDICATES CONDITIONS WHERE THE DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10 %. SEE SHEET 1 FOR GROSS WEIGHTS AND ALTITUDES CORRESPONDING TO AREAS A, B, C, D, AND E.

🟥 RED INDICATES AIRSPEED LIMITS.



DATA BASIS: DERIVED FROM FLIGHT TEST

Figure 7-5.1 Directional Control Margin Chart (Sheet 2 of 2)

SECTION V. TAKEOFF

7-21. DESCRIPTION.

The takeoff chart (figure 7-6) shows the distances to clear various obstacle heights, based upon several hover height capabilities. The upper chart grid presents data for climbout at a constant 35 knots INDICATED airspeed. The two lower grids present data for climbouts at various TRUE airspeeds.

NOTE

The hover heights shown on the chart are only a measure of the aircraft's climb capability and do not imply that a higher than normal hover height should be used during the actual takeoff.

7-22. USE OF CHART.

The primary use of the chart is illustrated by the chart examples. The main consideration for takeoff performance is the hovering skid height capability, which includes the effects of pressure altitude, free air temperature, gross weight, and torque. Hover height capability is determined by use of the hover chart, figure 7-5.

A hover check can be made to verify the hover capability. If winds are present, the hover check may disclose that the helicopter can actually hover at a greater skid height than the calculated value, since the hover chart is based upon calm wind conditions.

7-23. CONDITIONS.

WARNING

A tailwind during takeoff and climbout will increase the obstacle clearance distance and could prevent a successful takeoff.

a. **Wind.** The takeoff chart is based upon calm wind conditions. Since surface wind velocity and direction cannot be accurately predicted, all takeoff planning should be used upon calm wind conditions. Takeoff into any prevailing wind will improve the takeoff performance.

b. **Power Settings.** All takeoff performance data are based upon the torque used in determining the hover capabilities in figure 7-5.

TAKEOFF

LEVEL ACCELERATION TECHNIQUE 3 FT SKID HEIGHT

TAKEOFF
AH-1S
T53-L-703

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAXIMUM HOVER HEIGHT = 10 FEET
OBSTACLE HEIGHT = 50 FEET

METHOD

ENTER MAX HOVER HEIGHT HERE →

MOVE RIGHT TO OBSTACLE HEIGHT

MOVE DOWN, READ DISTANCE TO CLEAR OBSTACLE = 825 FEET

EXAMPLE B

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 8 FEET

OBSTACLE HEIGHT = 50 FEET

CLIMBOUT AIRSPEED = 40 KNOTS

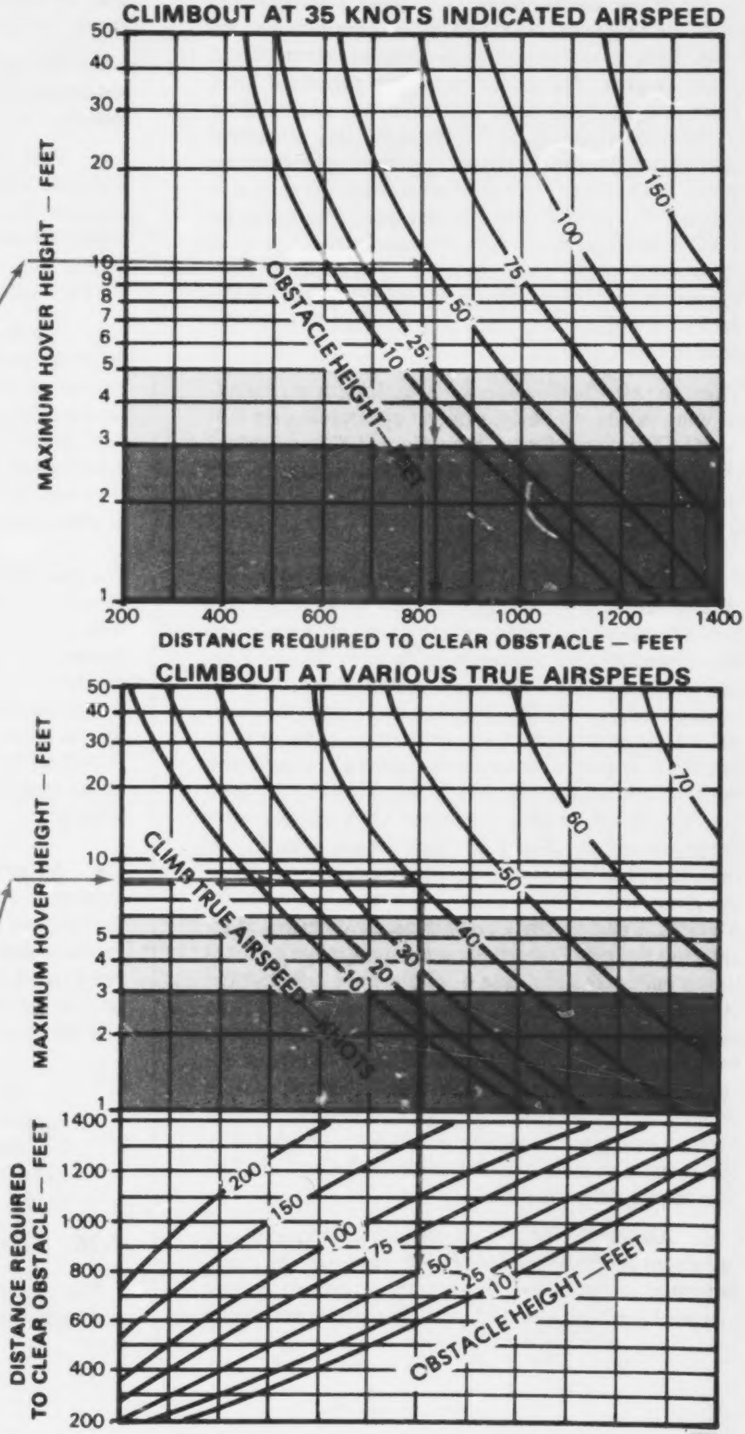
METHOD

ENTER MAX HOVER HEIGHT HERE →

MOVE RIGHT TO CLIMBOUT TRUE AIRSPEED

MOVE DOWN TO OBSTACLE HEIGHT

MOVE LEFT READ DISTANCE TO CLEAR OBSTACLE = 800 FEET



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 **Figure 7-6. Takeoff chart**

SECTION VI. CRUISE

7-24. DESCRIPTION.

The cruise charts (figure 7-7, sheet 1 through 23) show the torque pressure and engine rpm required for level flight at various pressure altitudes, airspeed and gross weights. The cruise charts are presented for a clean drag configuration. However, any desired drag configuration (see figure 7-8 for authorized armament configurations) can be solved by using a ratio between the □ % Q for the desired configuration (as shown in figure 7-7, sheets 1 thru 23) and the □ % Q for the 8 TOW configuration. Add the calculated □ % Q of the desired configuration to the % Q of the clean configuration to solve for the total torque required for the desired configuration. Then read the fuel flow for the desired configuration.

Thus, the effects of added drag resulting from installed wing stores can be determined by applying the □F — SQ FT from the Drag Chart (figure 7-8) to the cruise charts (figure 7-7). Refer to Example B on figure 7-7, sheet 1 for the method.

7-25. USE OF CHARTS.

The primary use of the charts is illustrated by the examples provided in figure 7-7. The first step for chart use is to select the proper chart, pressure altitude and anticipated free air temperature; refer to chapter 7 index (paragraph 7-2). Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude and FAT. If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (see figure 7-7, sheet 1, example A). You may enter the charts on any side: TAS, IAS, torque pressure, or fuel flow, and then move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight; then read airspeed, fuel flow and torque pressure. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights it is preferable to determine cruise information for several flight segments in order to allow for decreasing fuel weight (reduced gross weight). The following parameters contained in each chart are further explained as follows:

a. Airspeed. True and indicated airspeeds are presented at opposite sides of each chart. On any chart, indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (VNE) limits appear as red lines on some charts. If no red line appears, VNE is above the limits of the chart.

b. Torque Pressure (% Q). Since pressure altitude and temperature are fixed for each chart, torque pressure required varies according to gross weight and airspeed.

c. Fuel Flow. Fuel flow scales are provided opposite the torque pressure scales. On any chart, torque pressure may be converted directly to fuel flow without regard for other chart information. All fuel flow information is presented ECS off. Add 4 percent fuel flow for ECS on.

d. Maximum Range. The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart it is because the maximum range speed is beyond the maximum permissible speed (VNE); in such cases, use VNE cruising speed to obtain maximum range.

The maximum range line labeled "8 TOW" simply indicates the maximum range speed for a configuration with a □ fe of five square feet more than the clean configuration. For all drag configurations other than clean, the delta torque required must be added to determine torque required and fuel flow. The maximum range lines for the clean configuration (□fe =0) and 8 TOW (□ fe = 5 sq ft) may be used as a guide to estimate maximum range speed for configurations with other drag values.

e. Maximum Endurance and Rate of Climb. The maximum endurance and rate of climb lines indicate the airspeed for minimum torque pressure required to maintain level flight for each gross weight, FAT and pressure altitude. Since minimum torque pressure will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeed indicated.

NOTE

Torque available data shown in figures 7-3, 7-4, and 7-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7-1.

7-26. CONDITIONS.

The cruise charts are based on operation at 100 percent rpm and ECS off.

CRUISE

PRESSURE ALTITUDE — SEA LEVEL

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = -30°C

EXAMPLE A

WANTED

TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

CLEAN CONFIGURATION, GROSS WEIGHT = 8000 LB, PRESSURE ALTITUDE = 1000 FEET, FAT = -30°C, DESIRED TRUE AIRSPEED = 110 KNOTS.

METHOD (INTERPOLATE)

ENTER TRUE AIRSPEED HERE

READ TORQUE, FUEL FLOW, AND IAS ON EACH ADJACENT ALTITUDE AND/OR FAT, THEN INTERPOLATE BETWEEN ALTITUDE AND FAT

SEE FIGURE 7-7 (SHT 2) ①

ALTITUDE, FEET	SEA LEVEL	2000 FEET	1000 FEET
FAT, °C	-30	-30	-30
TORQUE, % Q	63.5	61.5	62.5
FUEL FLOW, LB/HR	600	570	585
IAS, KNOTS	124	119	121.5

EXAMPLE B

WANTED

ADDITIONAL TORQUE REQUIRED AND FUEL FLOW FOR ARMAMENT CONFIGURATION AND CONDITION IN EXAMPLE A

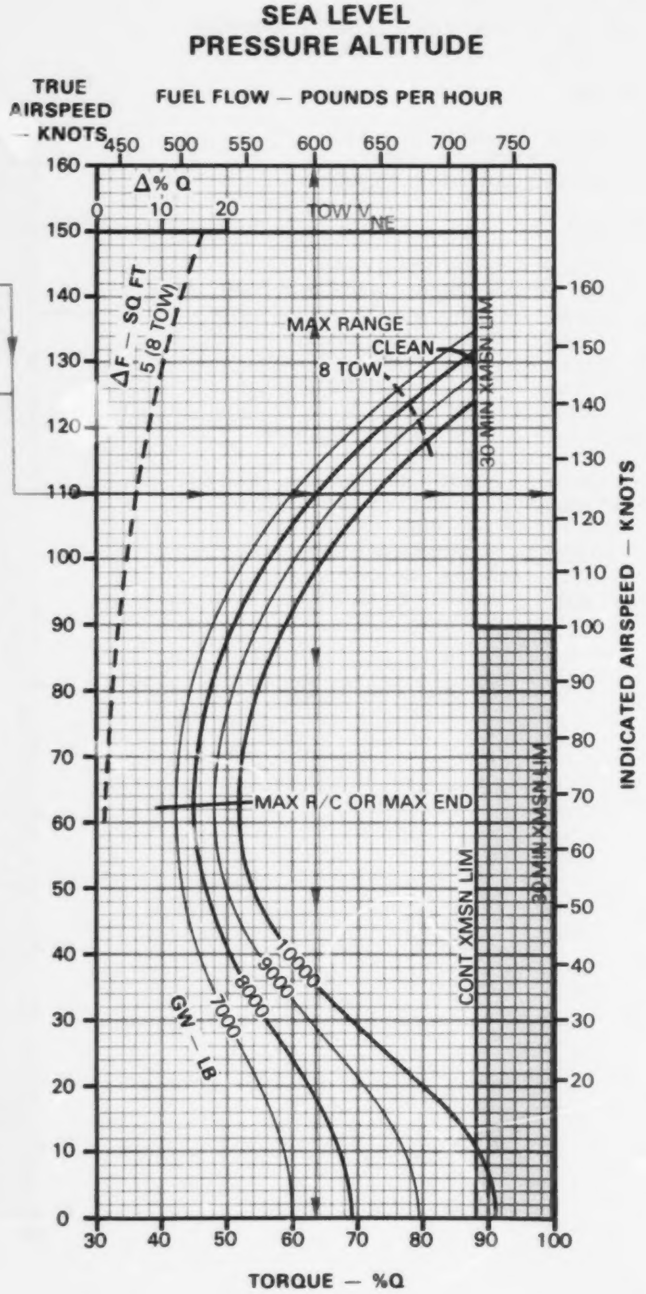
KNOWN

ARMAMENT CONFIGURATION FOR 2 19 TUBE ROCKET LAUNCHERS = 3.1 ΔF -SQ FT (FROM FIGURE 7-8)

METHOD

ENTER TRUE AIRSPEED AT 110 KNOTS AND MOVE RIGHT TO ΔF- SQ FT = 3.1 (BETWEEN 0.0 AND 5.0 ΔF - SQ FT). FROM THAT POINT MOVE UP TO READ 3.7% Q TORQUE. ADD 3.7% Q TORQUE TO THE TORQUE REQUIRED FOR LEVEL FLIGHT IN THE CLEAN CONFIGURATION AND THE CORRESPONDING INCREASE IN FUEL FLOW (APPROXIMATELY 18 POUNDS PER HOUR) TO THE CLEAN CONFIGURATION FUEL FLOW.

DATA BASIS: DERIVED FROM FLIGHT TEST



B540 Figure 7-7. Cruise Chart (Sheet 1 of 23)

CRUISE

PRESSURE ALTITUDE — 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -30°C

EXAMPLE

WANTED

SPEED FOR MAXIMUM RANGE
TORQUE REQUIRED AND FUEL FLOW AT MAXIMUM
RANGE SPEED FOR MAXIMUM ENDURANCE

KNOWN

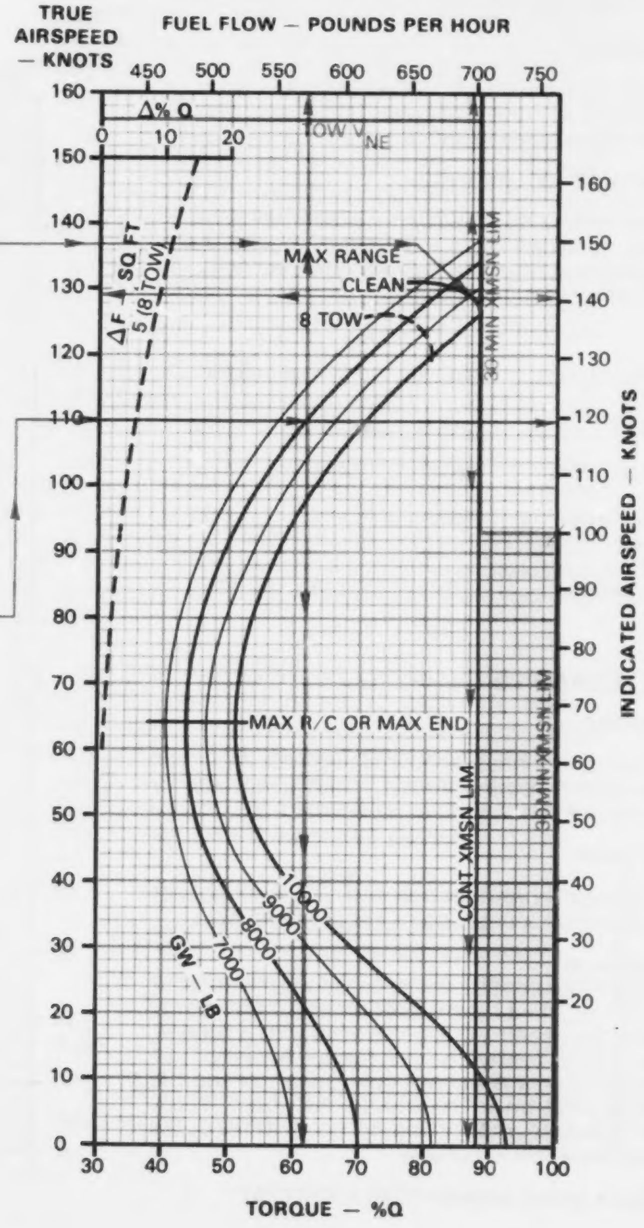
CLEAN CONFIGURATION, FAT = -30°C,
PRESSURE ALTITUDE = 2000 FEET,
AND GROSS WEIGHT = 9000 POUNDS

METHOD

LOCATE (-30°C FAT, 2000 FEET) CHART
FIND INTERSECTION OF 9000 LB GROSS WEIGHT
LINE WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
MOVE LEFT, READ TAS = 129 KNOTS AND
MOVE RIGHT, READ IAS = 141 KNOTS
TO READ FUEL FLOW REQUIRED:
MOVE UP, READ DUEL FLOW = 695 LB/HR
TO READ TORQUE REQUIRED
MOVE DOWN, READ TORQUE = 87% Q
FIND INTERSECTION OF 9000 LB GROSS WEIGHT
LINE WITH THE MAXIMUM ENDURANCE LINE
TO READ SPEED FOR MAXIMUM ENDURANCE:
MOVE LEFT, READ TAS = 64 KNOTS AND
MOVE RIGHT, READ IAS = 67 KNOTS

SEE FIGURE 7-7 (SHT 1) ①

2000 FEET
PRESSURE ALTITUDE



DATA BASIS: DERIVED FROM FLIGHT TEST

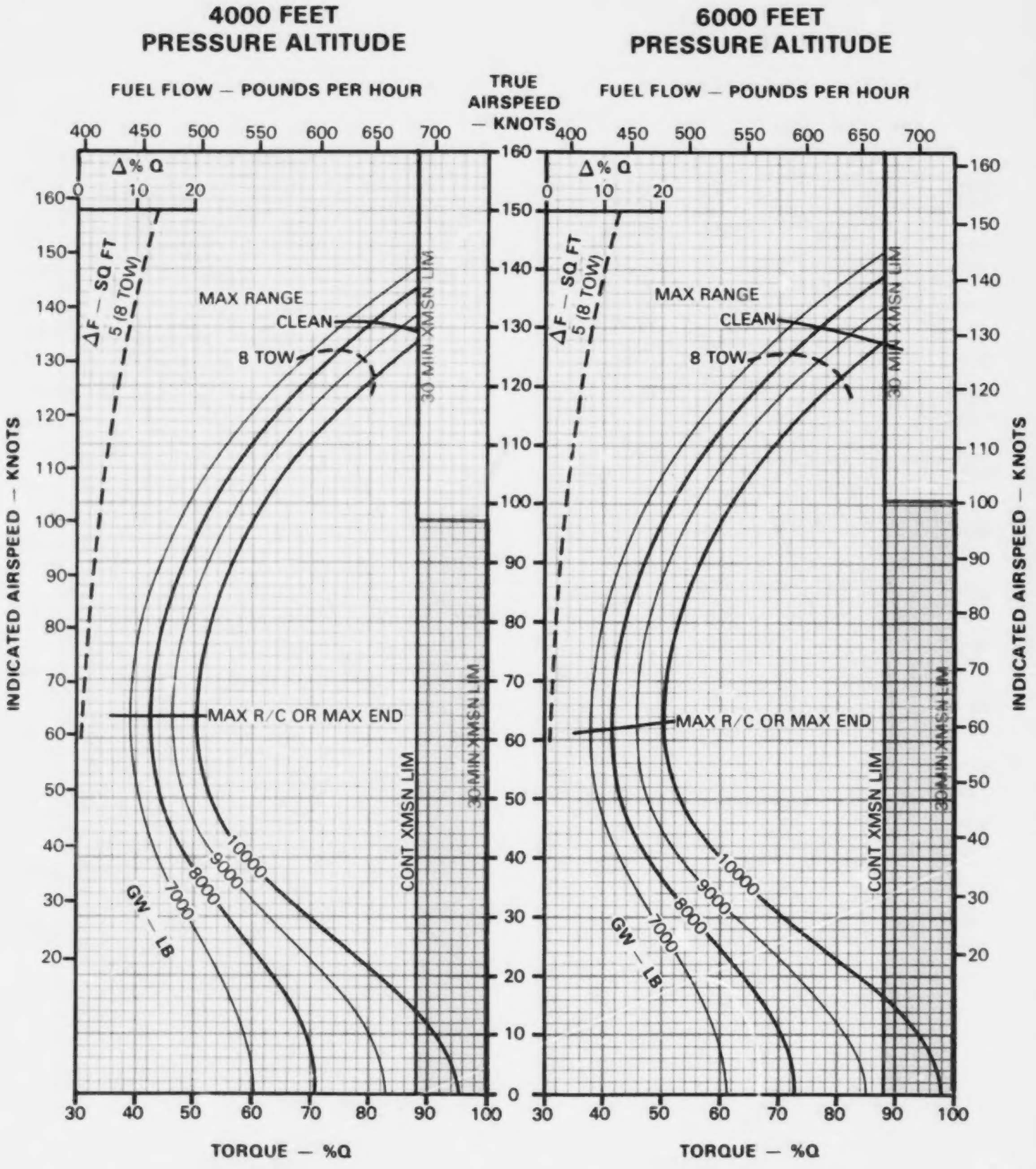
B540 **Figure 7-7. Cruise Chart (Sheet 2 of 23)**

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 3 of 23)

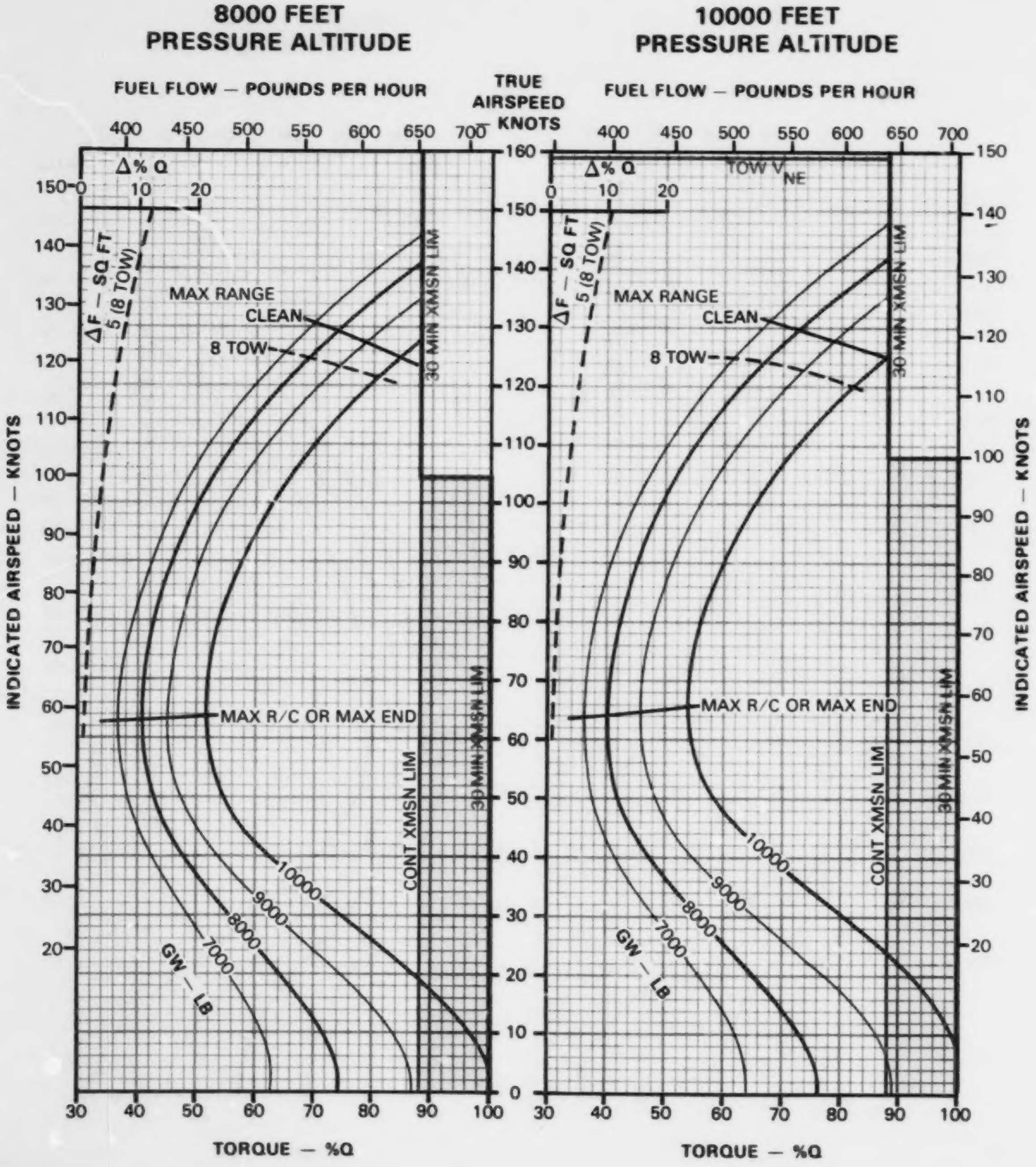
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

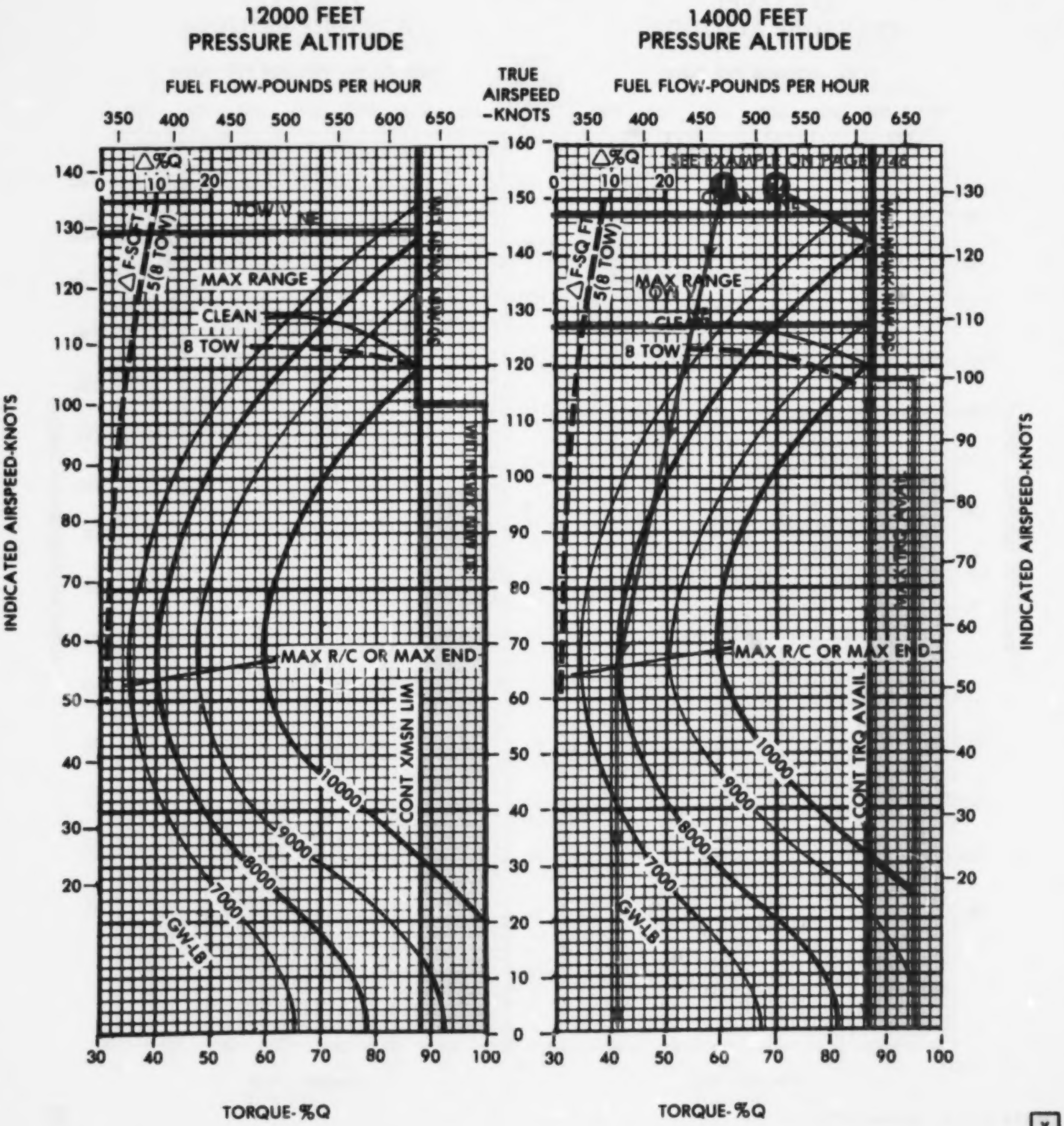
B540 Figure 7-7. Cruise Chart (Sheet 4 of 23)

CRUISE

PRESSURE ALTITUDE -12000 FEET TO 14000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -30°C



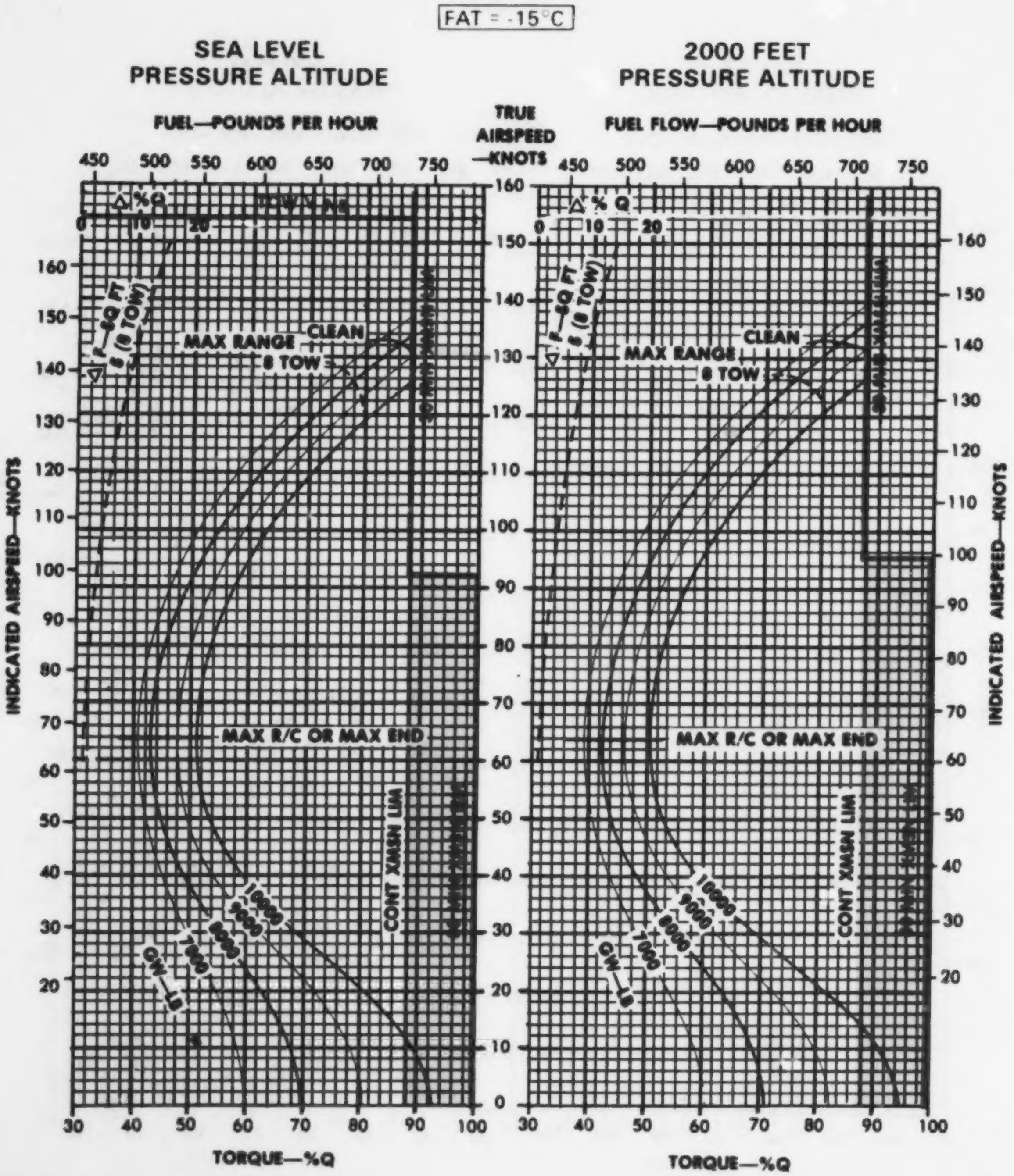
DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 5 of 23)

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL



DATA BASIS: DERIVED FROM FLIGHT TEST

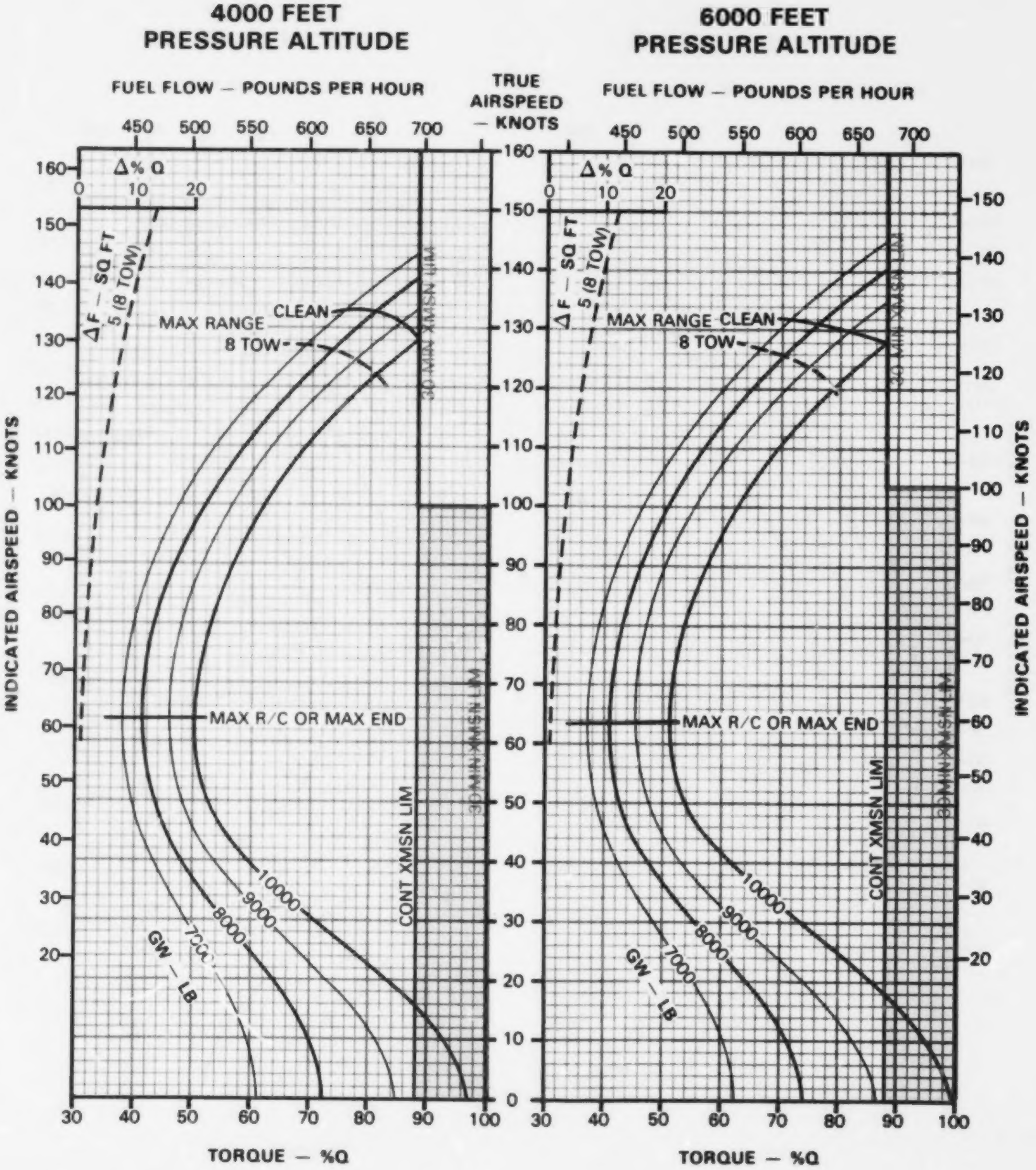
B540 Figure 7-7. Cruise Chart (Sheet 6 of 23)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = -15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 7 of 23)

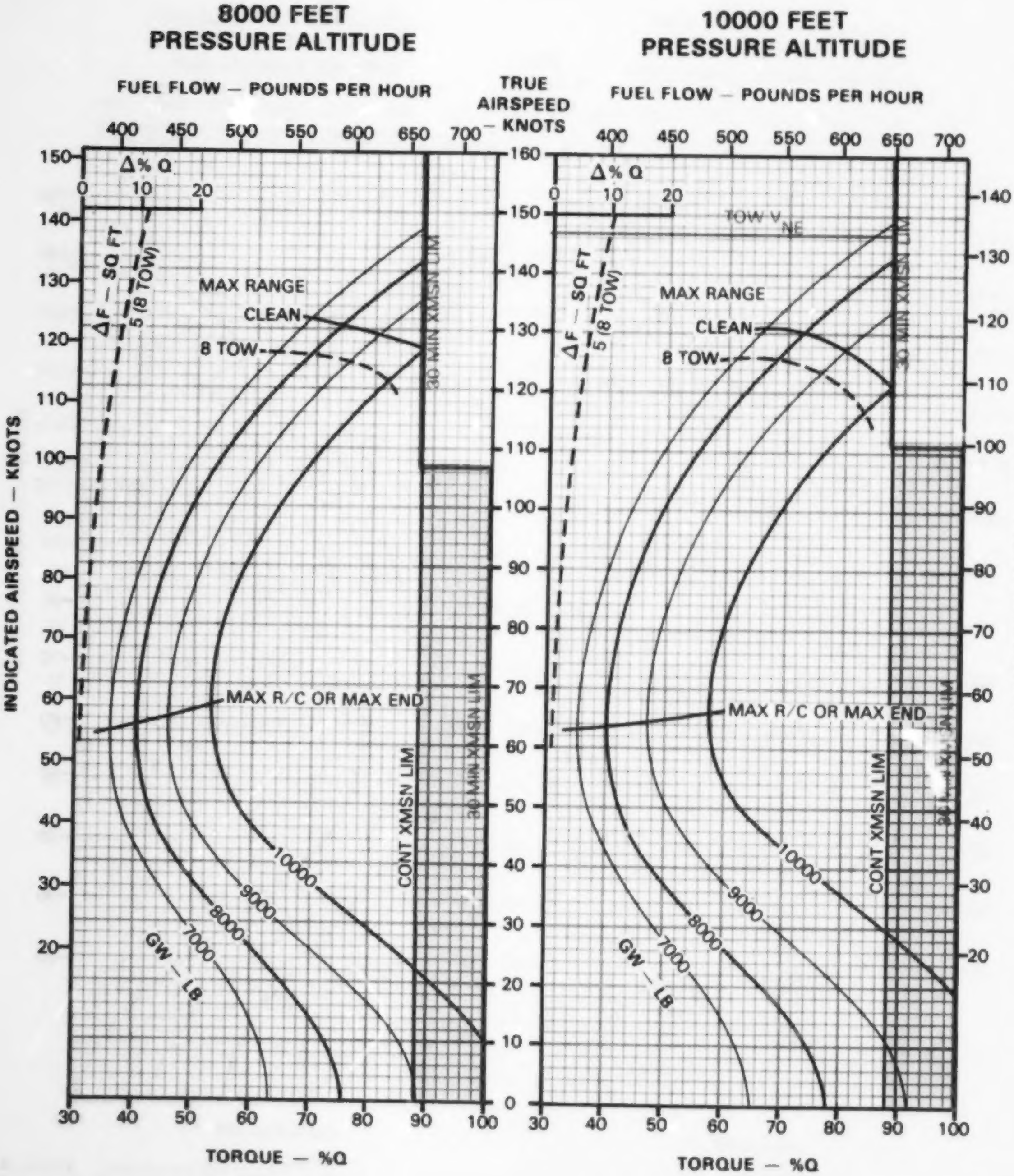
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

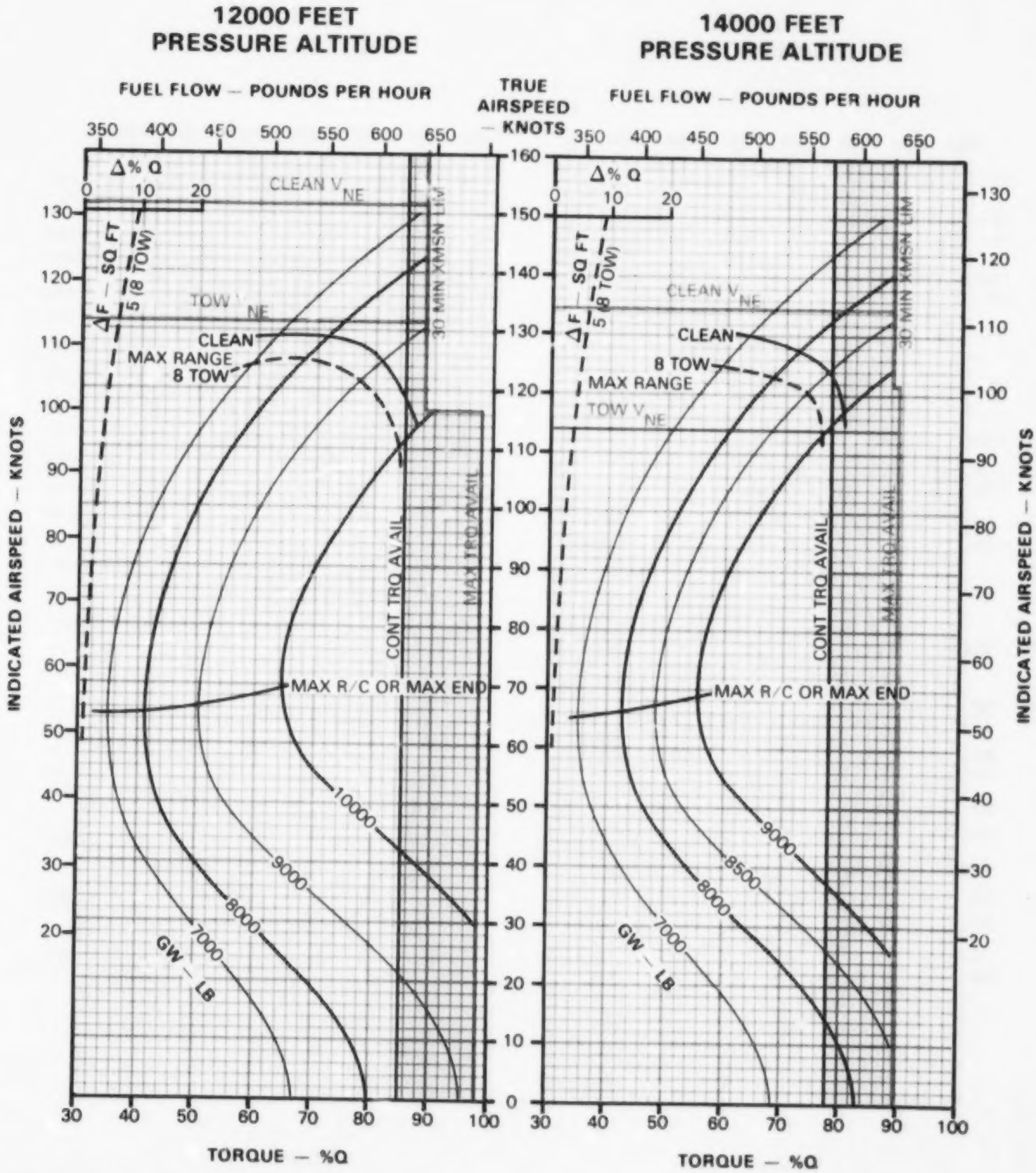
B540 Figure 7-7. Cruise Chart (Sheet 8 of 23)

CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = -15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

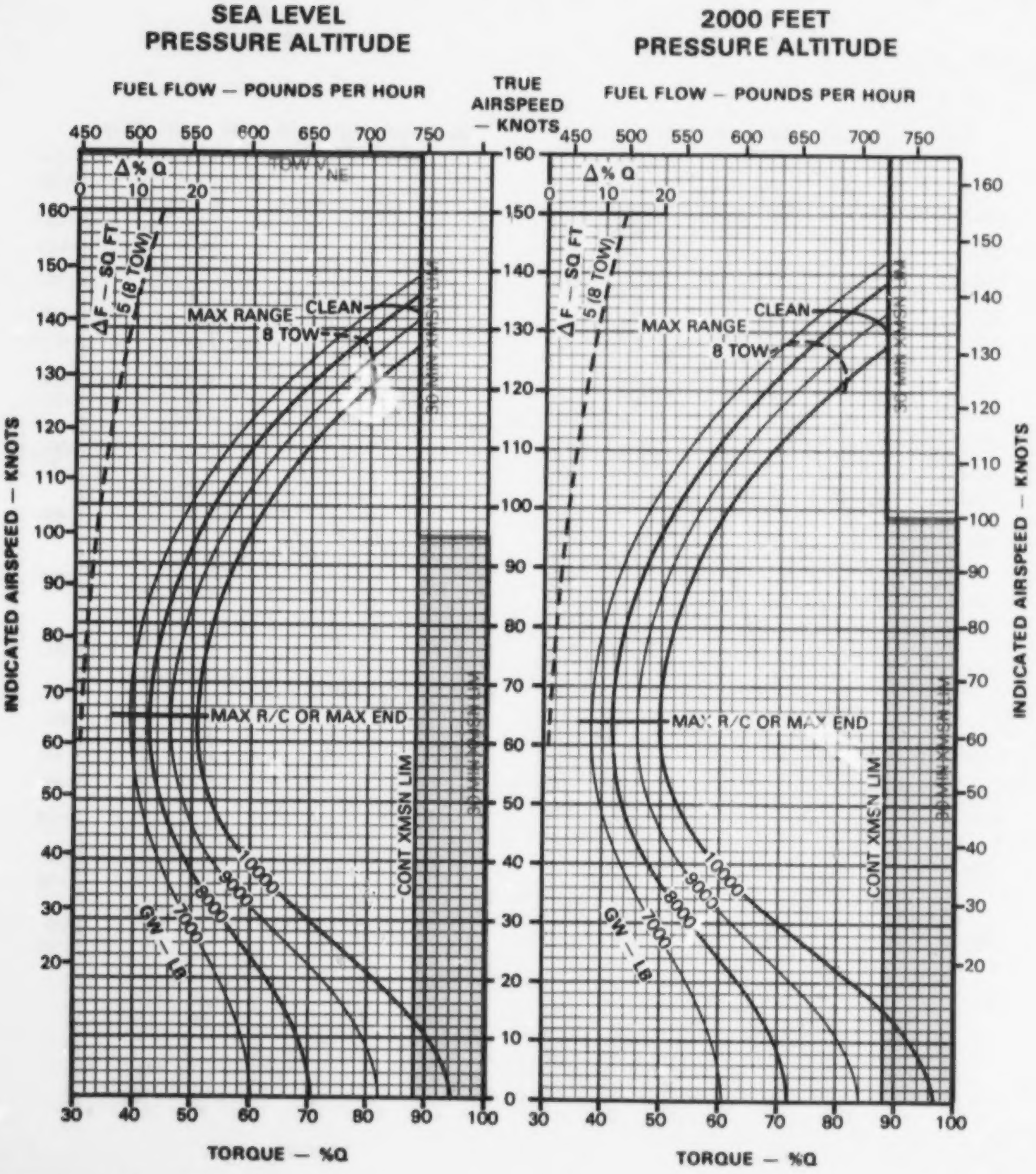
B540 Figure 7-7. Cruise Chart (Sheet 9 of 23)

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 10 of 23)

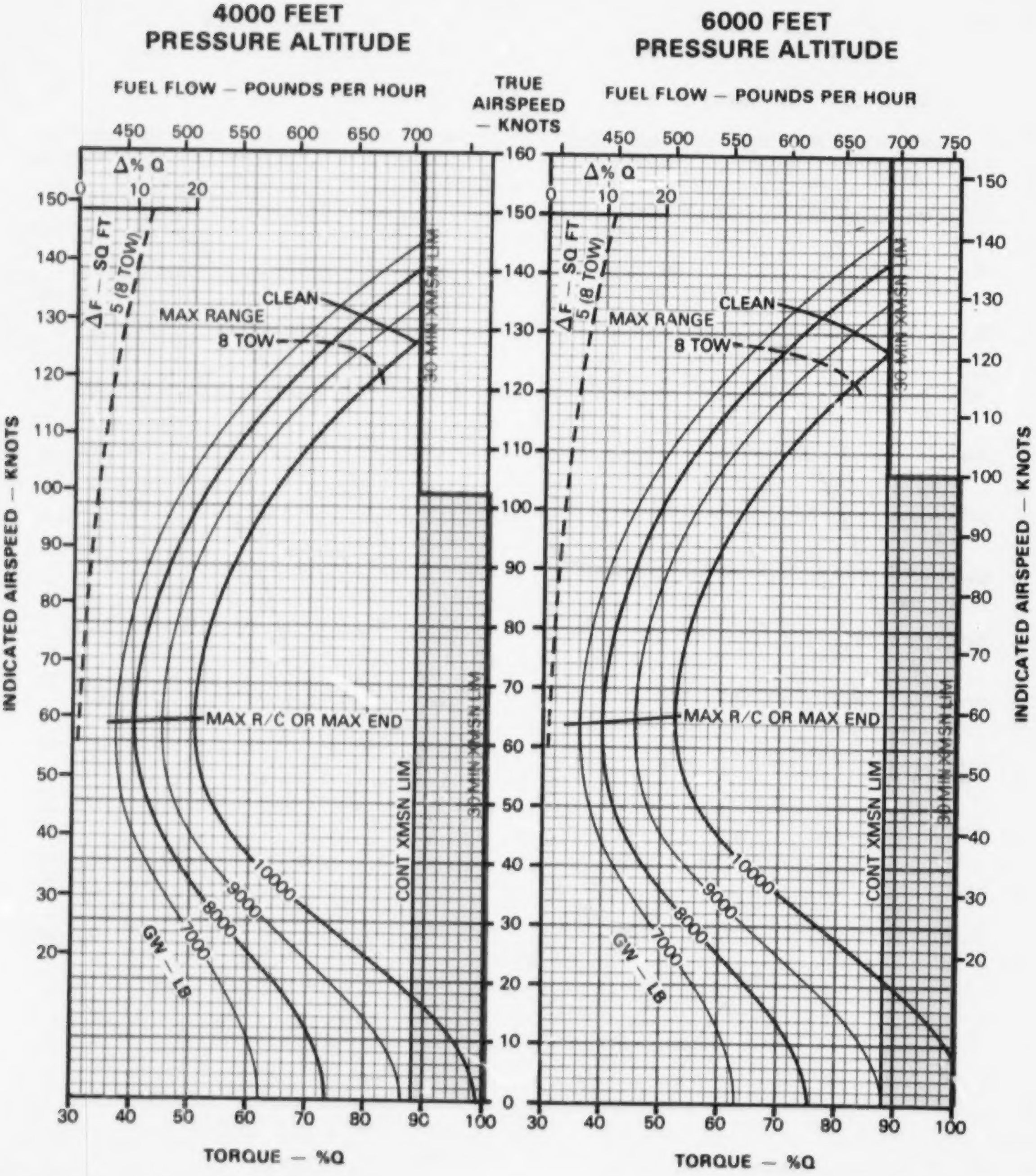
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 11 of 23)

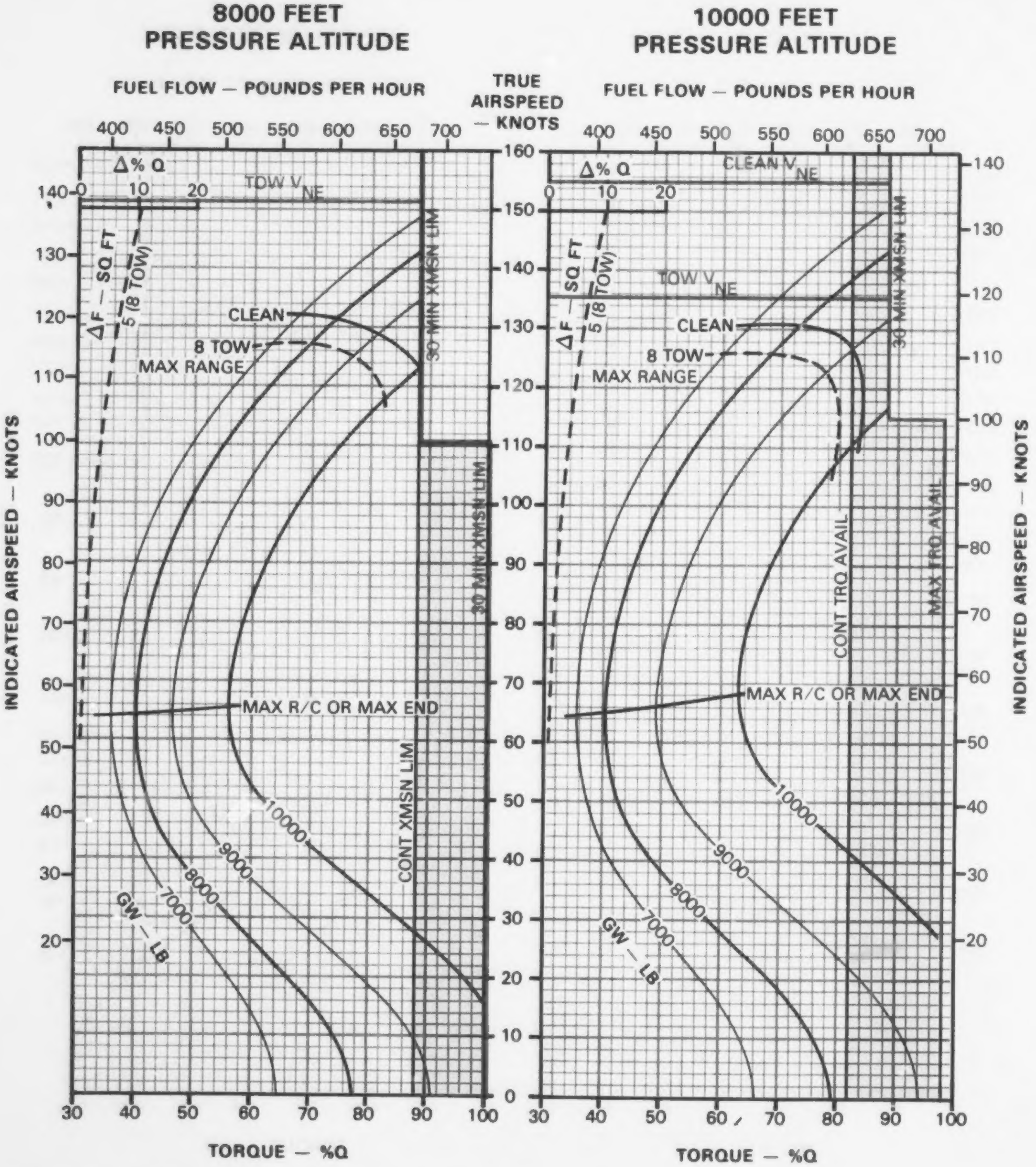
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = 0°C

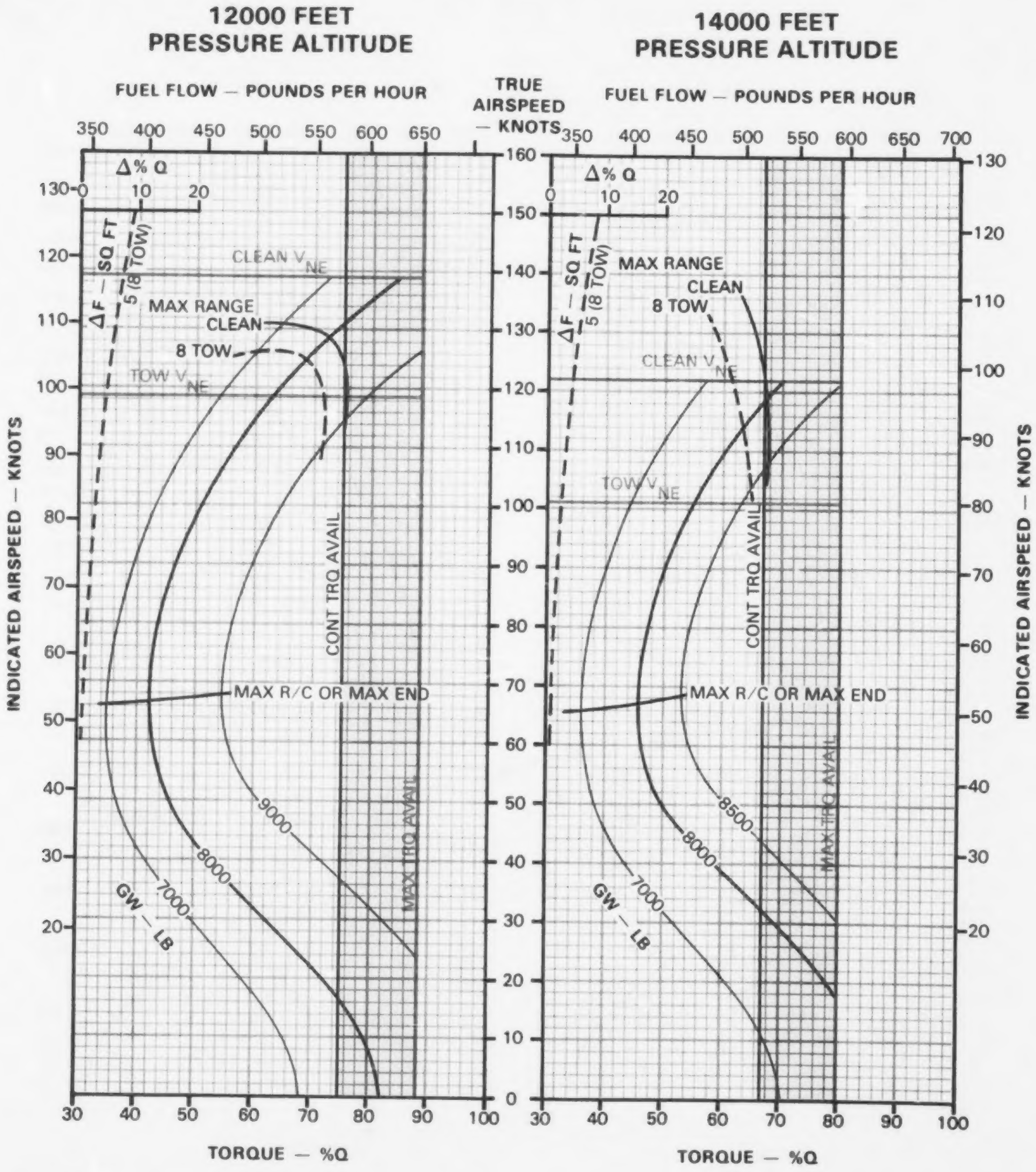


DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 12 of 23)

CRUISE
PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 13 of 23)

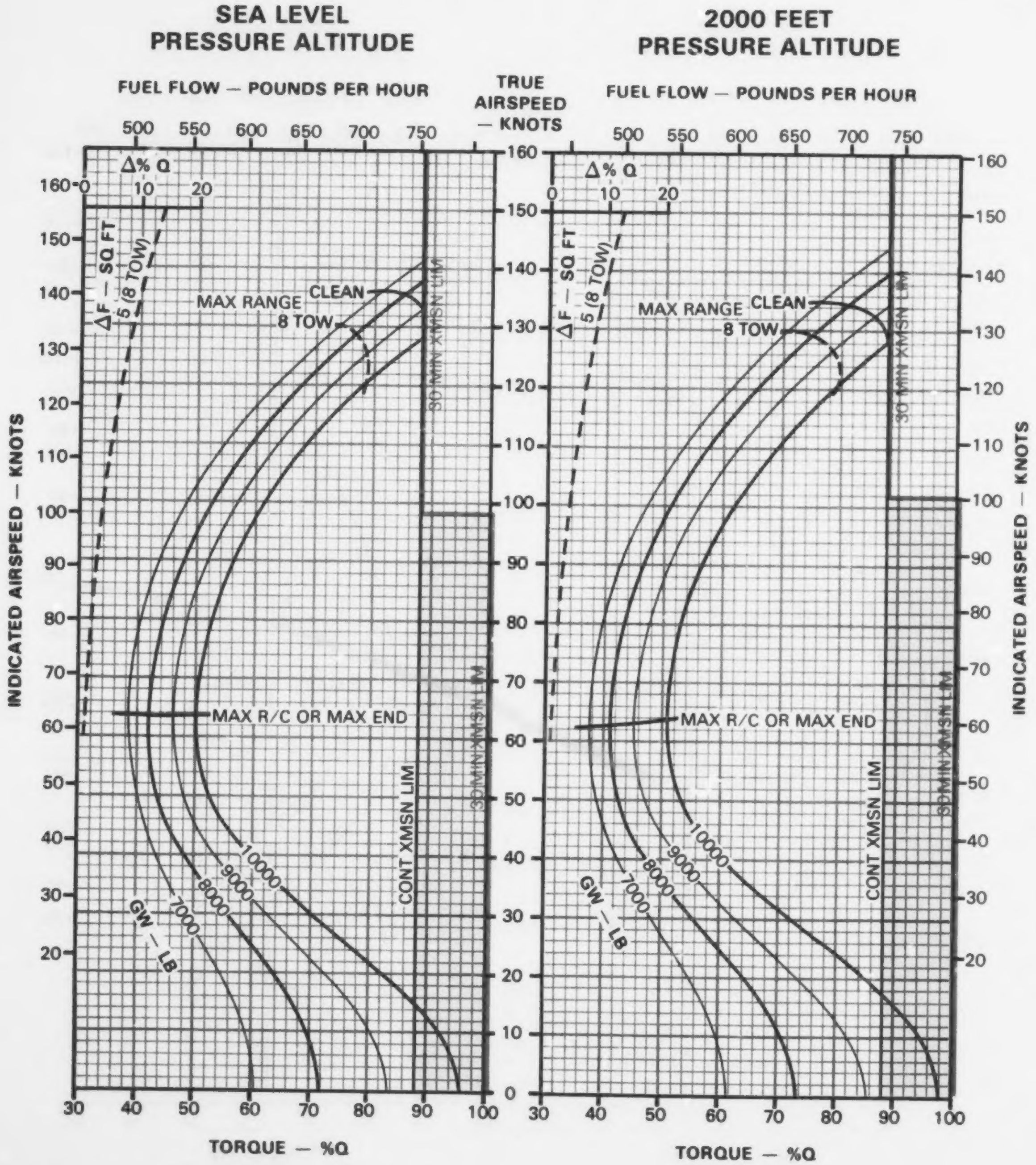
CRUISE
AH-1S
T53-L-703

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

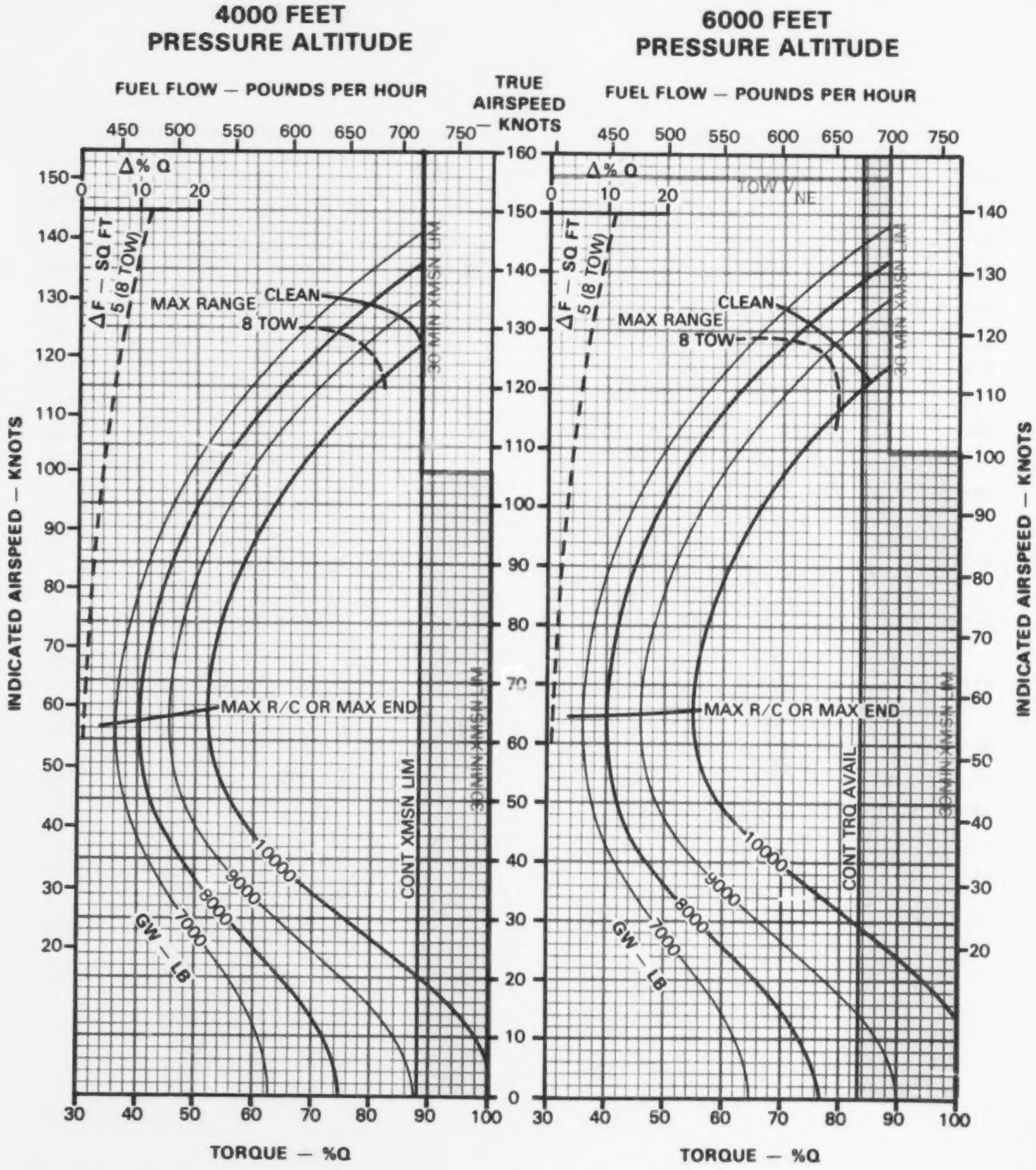
B540 Figure 7-7. Cruise Chart (Sheet 14 of 23)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 **Figure 7-7. Cruise Chart (Sheet 15 of 23)**

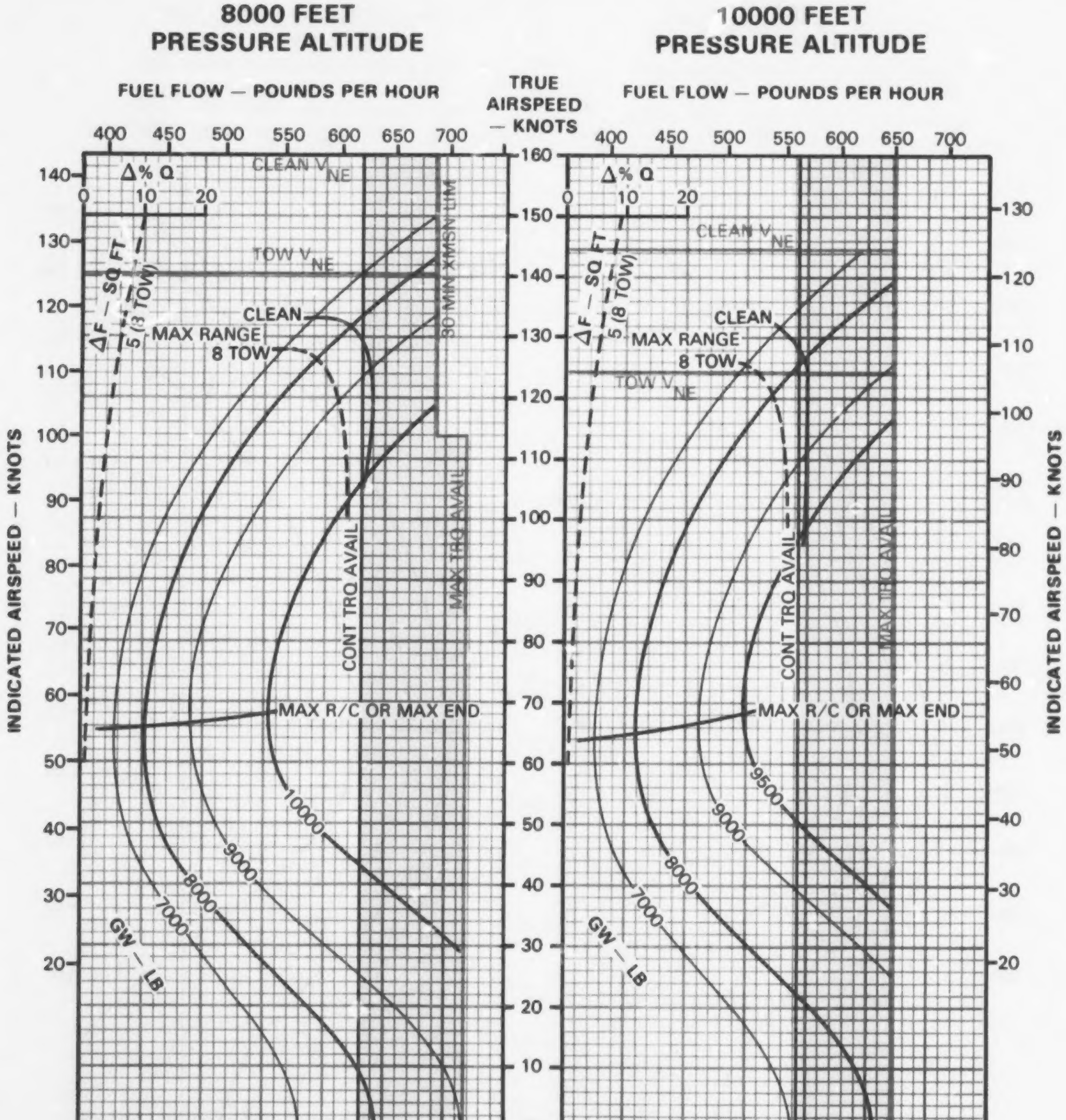
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

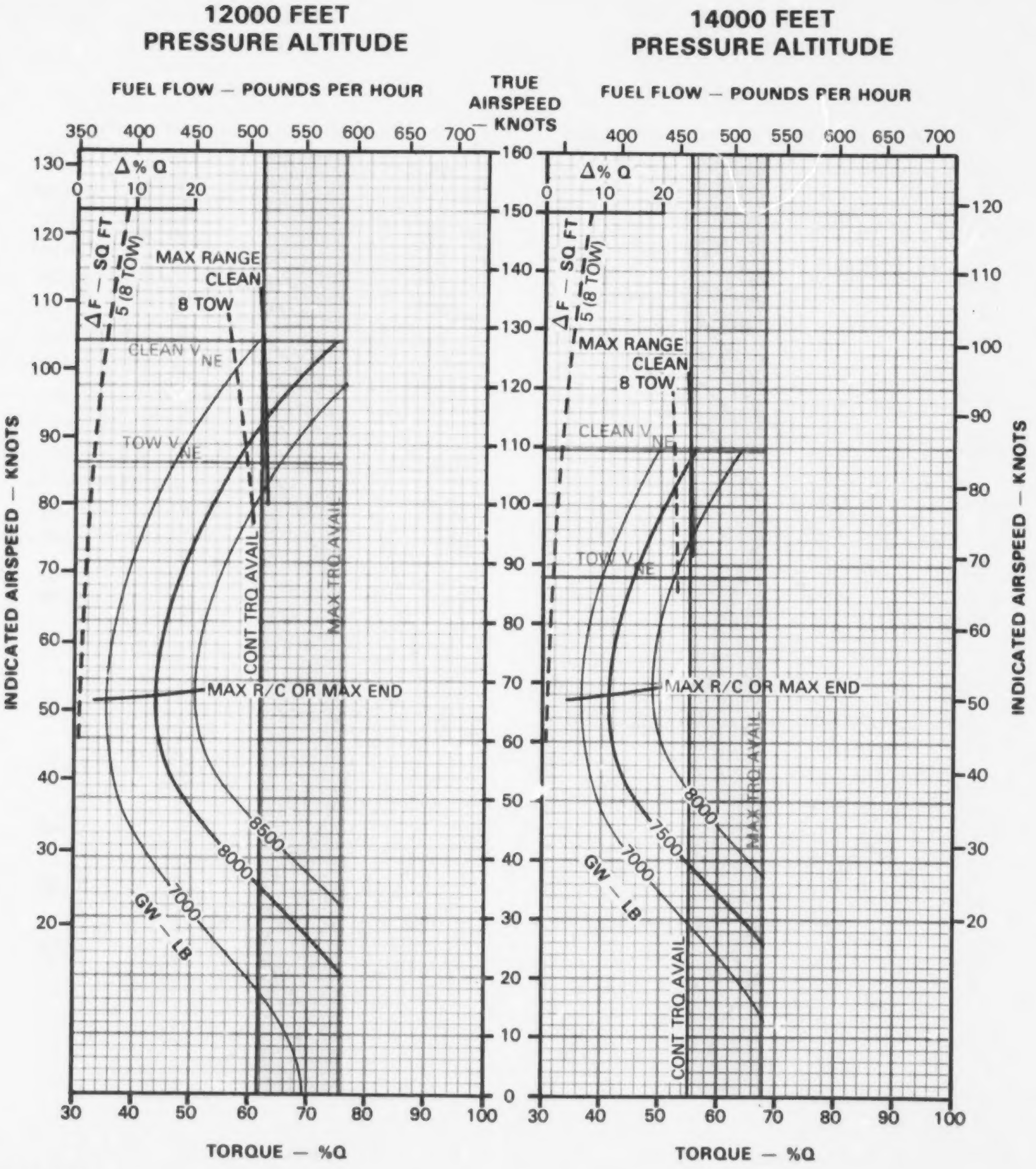
B540 Figure 7-7. Cruise Chart (Sheet 16 of 23)

CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +15°C



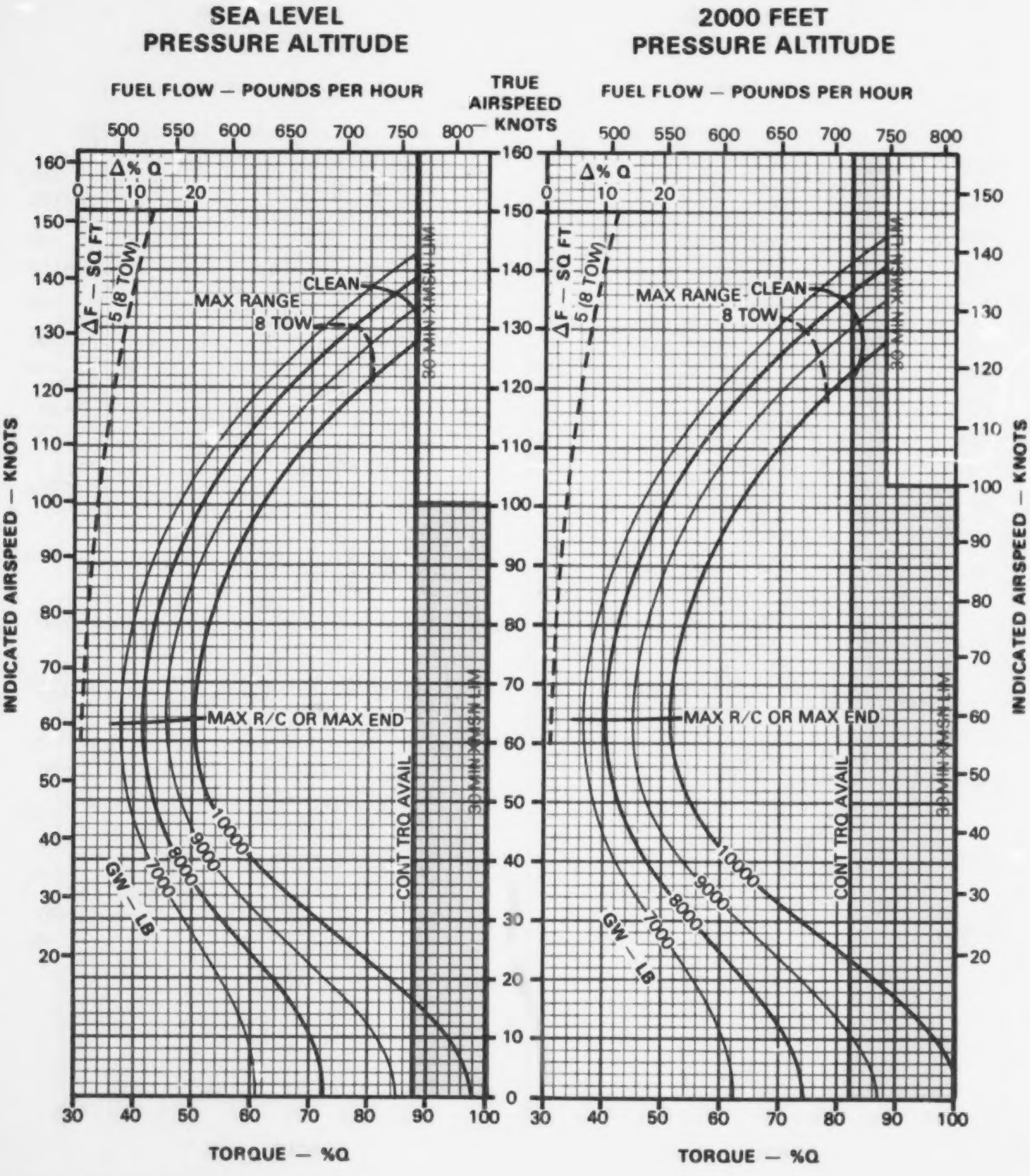
DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 17 of 23)

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

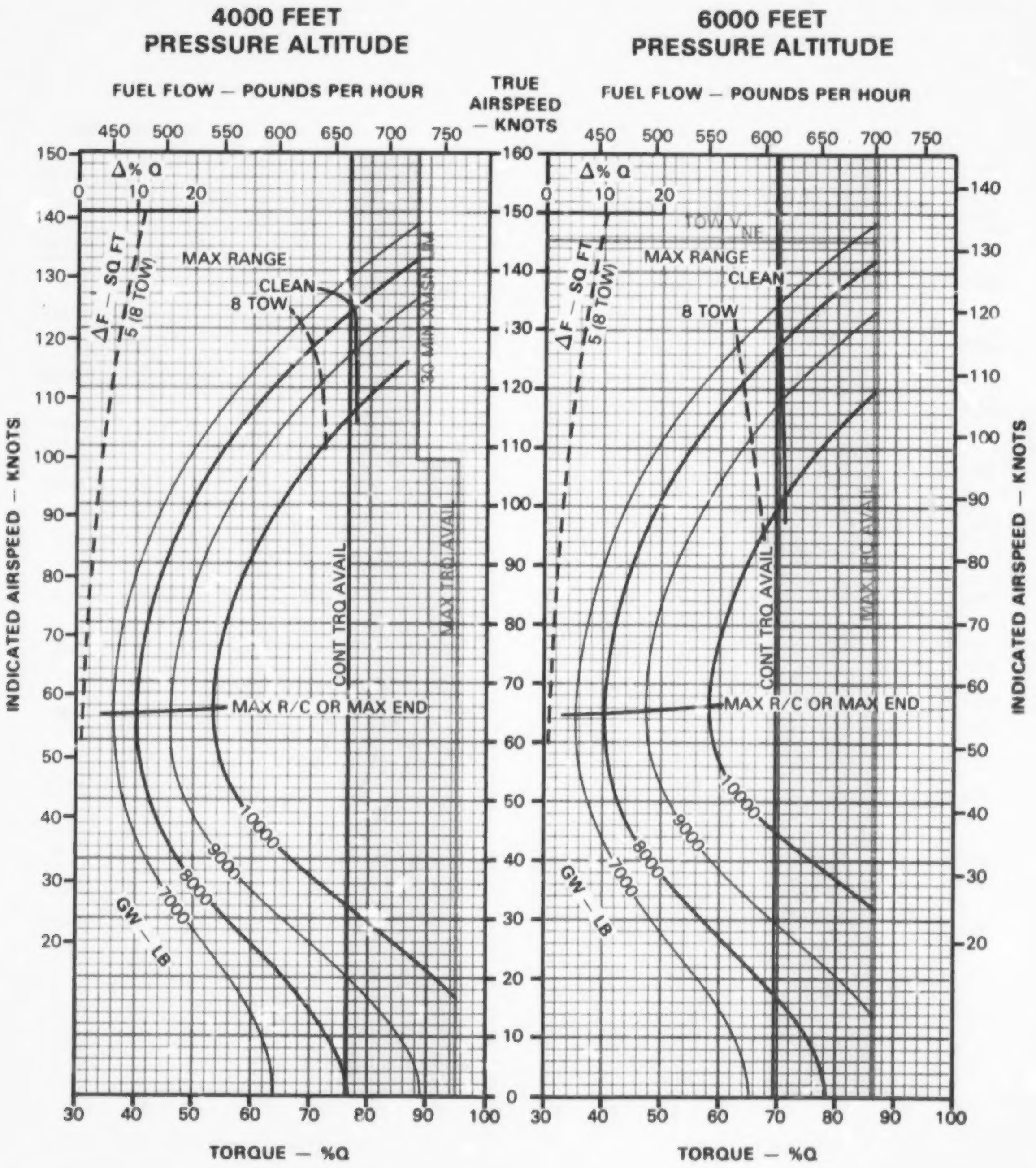
B540 Figure 7-7. Cruise Chart (Sheet 18 of 23)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

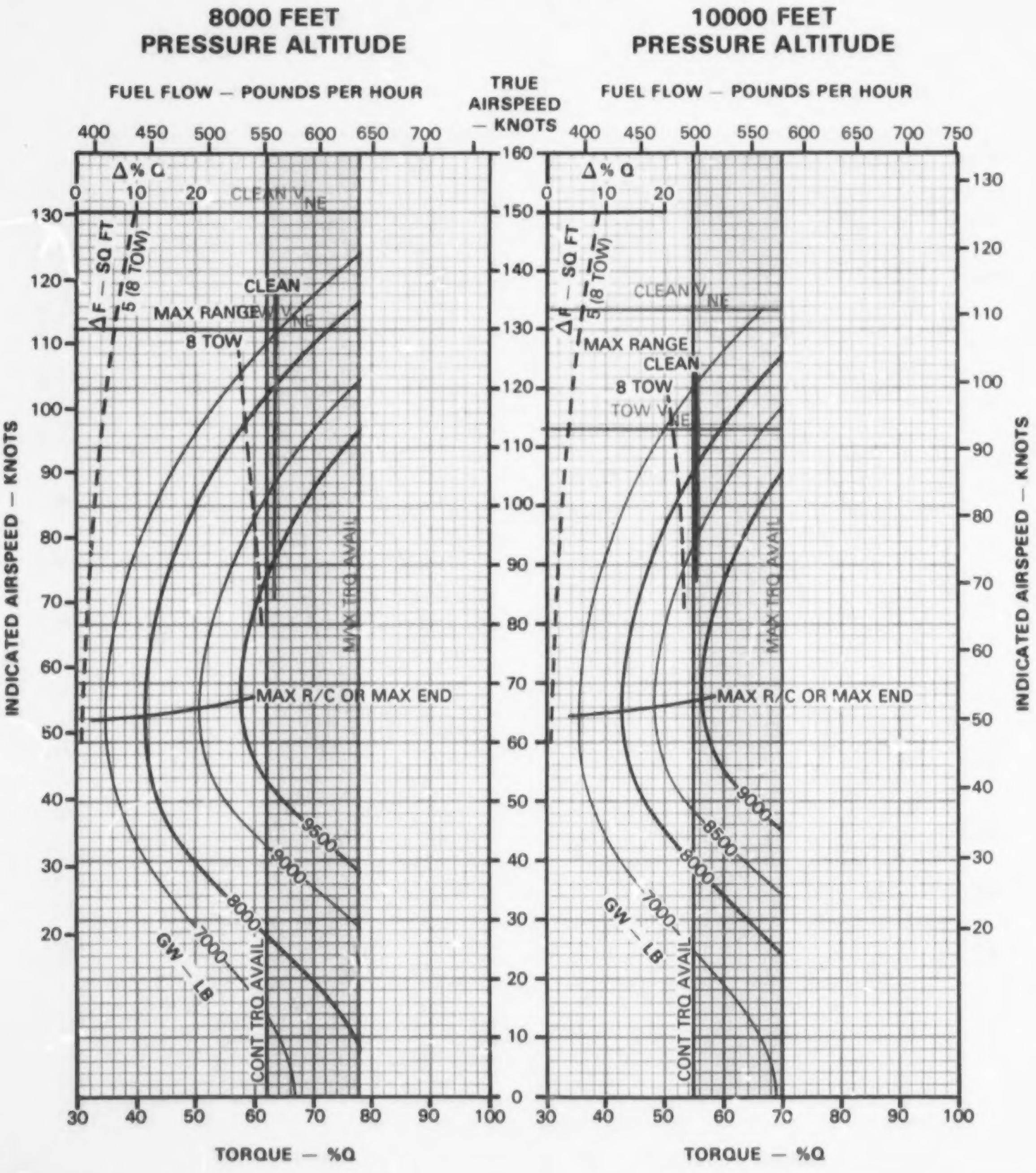
B540 Figure 7-7. Cruise Chart (Sheet 19 of 23)

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +30°C



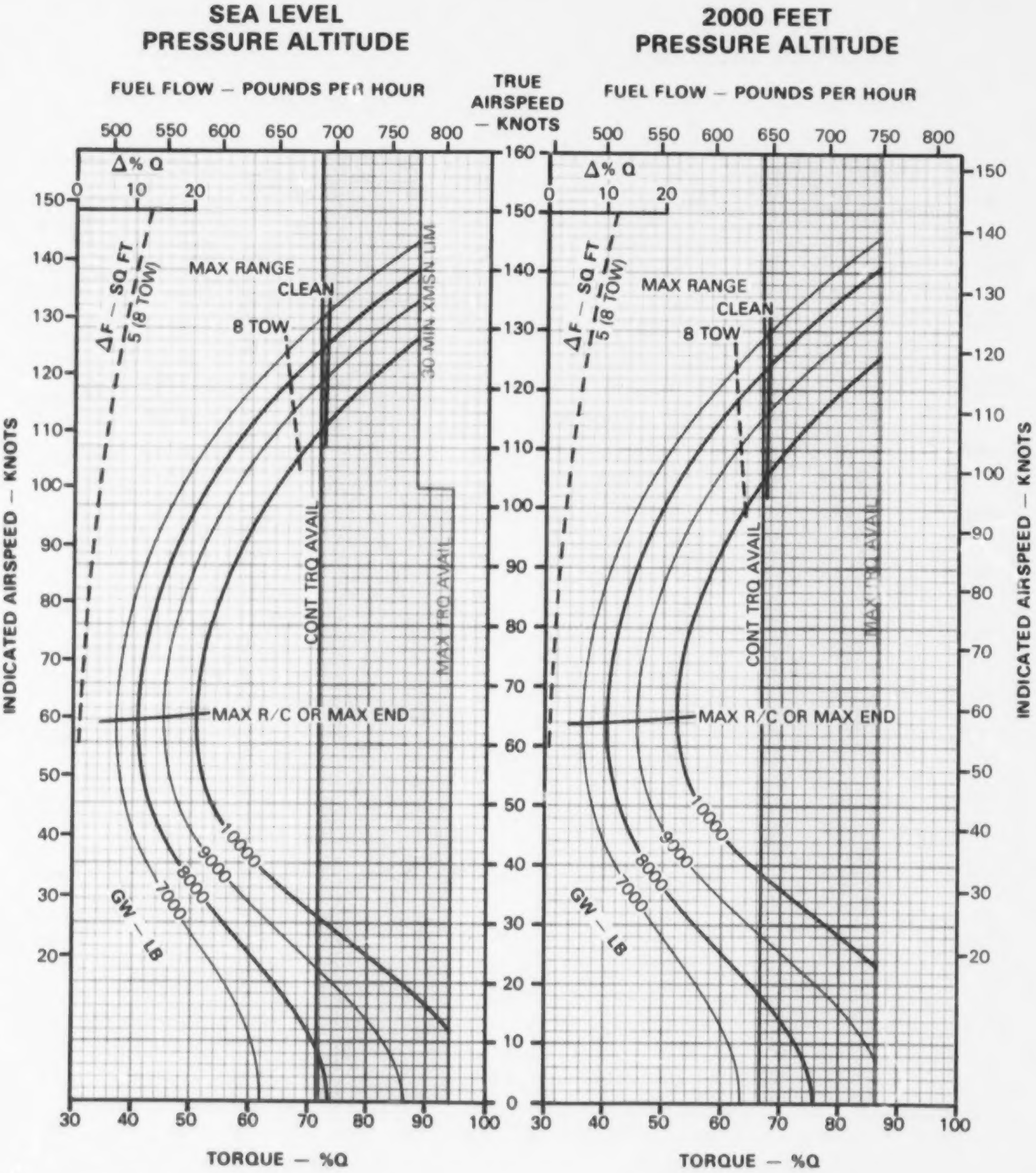
DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 20 of 23)

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +45°C


SEA LEVEL PRESSURE ALTITUDE

2000 FEET PRESSURE ALTITUDE

DATA BASIS: DERIVED FROM FLIGHT TEST

B540 Figure 7-7. Cruise Chart (Sheet 21 of 23)

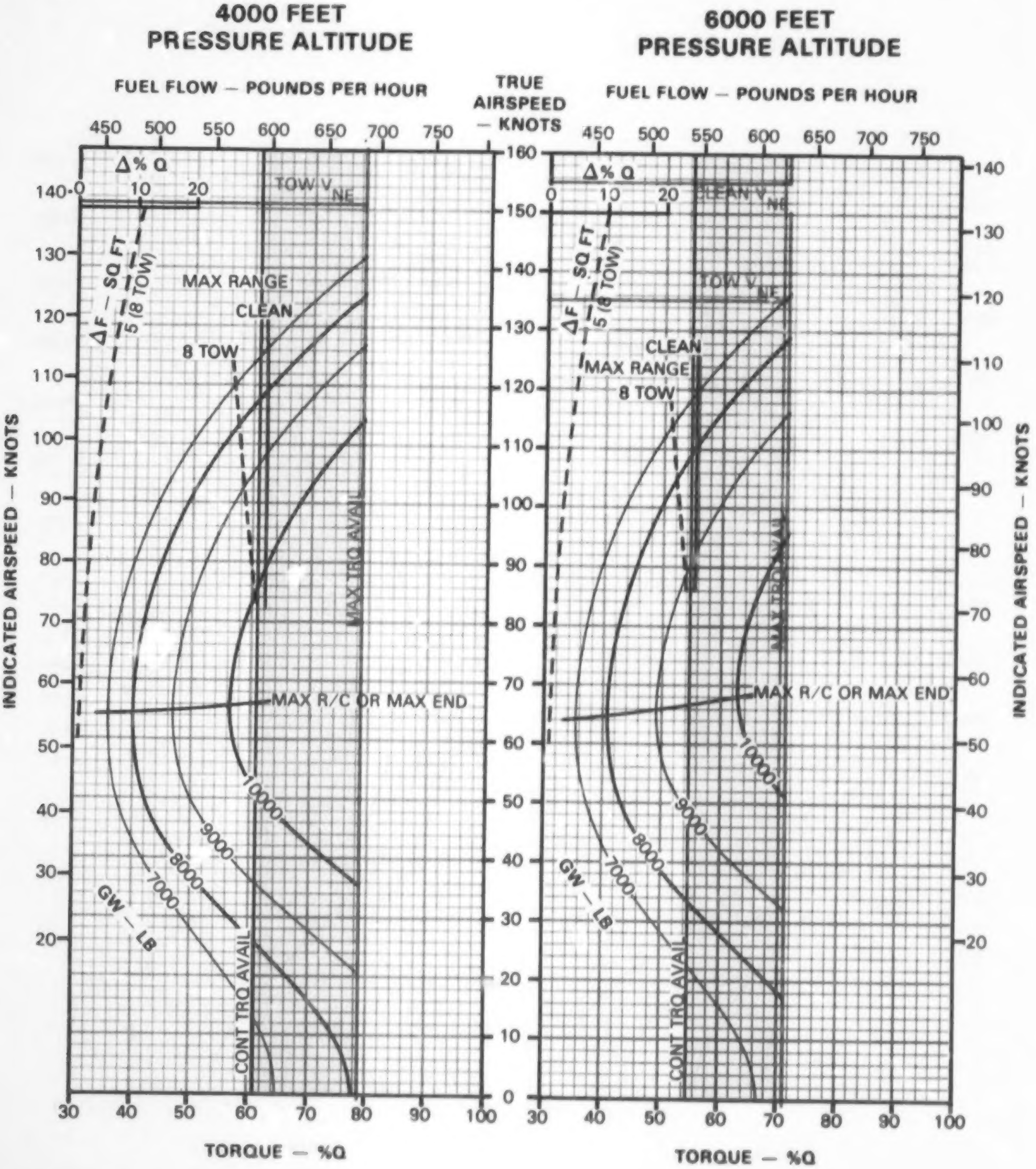
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 **Figure 7-7. Cruise Chart (Sheet 22 of 23)**

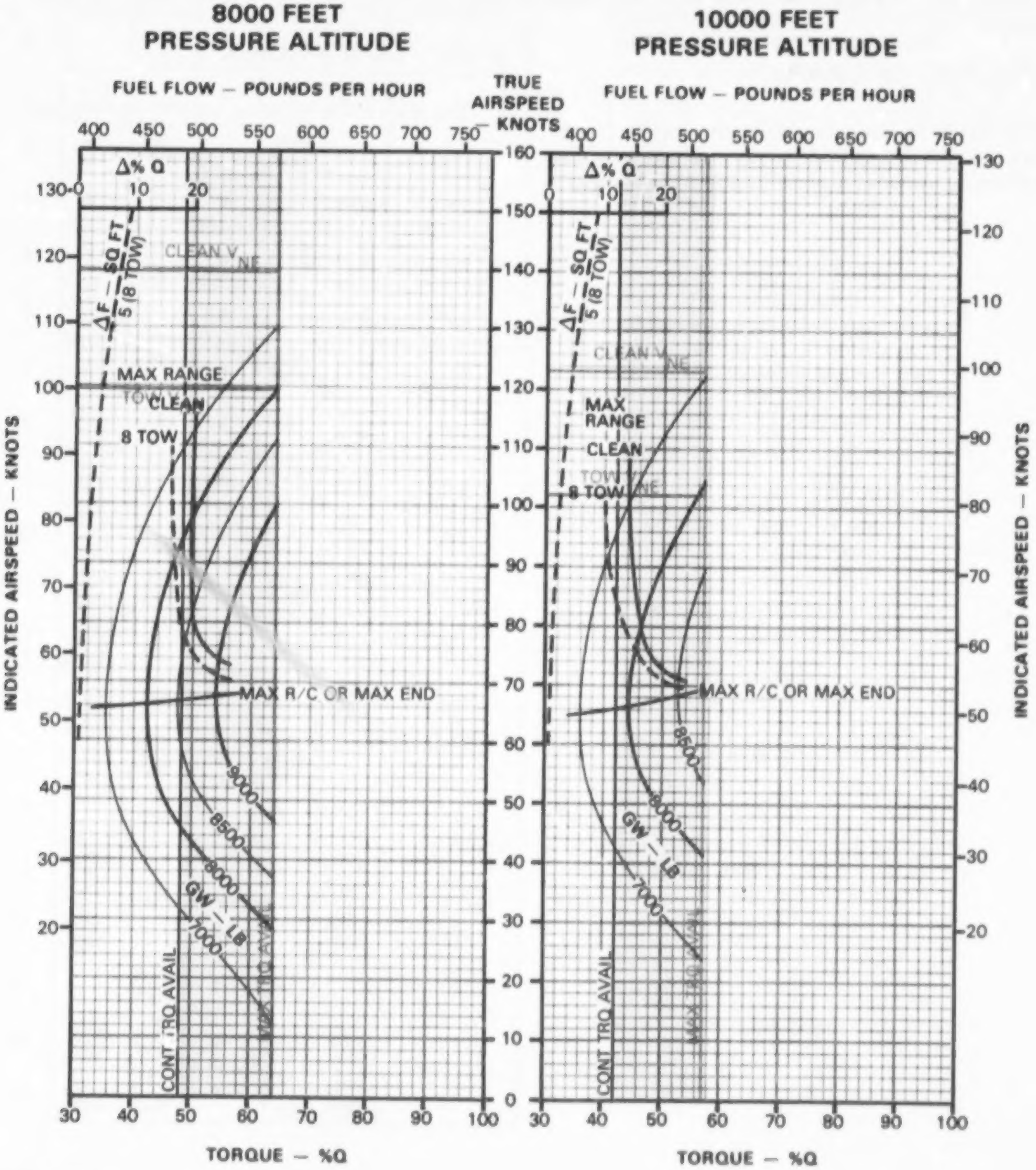
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST

B540 **Figure 7-7. Cruise Chart (Sheet 23 of 23)**

SECTION VII. DRAG

7-27. DESCRIPTION.

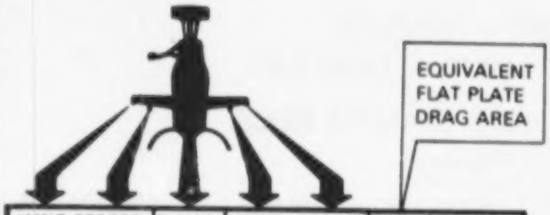
The drag chart (figure 7-8) shows the equivalent flat plate drag area (△F) increment of all approved configurations.

7-28. USE OF CHART.

This chart is used to adjust the cruise charts (figure 7-7) for the appropriate torque and fuel flow due to the equivalent flat plate drag area change (△F). Select a configuration from figure 7-8 and read equivalent flat plate drag for that configuration. Proceed to figure 7-7, example B for application of drag.

7-29. CONDITIONS.

The drag chart is based on 100 percent rpm.



ARMAMENT CONFIGURATION	WING STORES		TURRET	WING STORES		ΔF · SQ FT
1			A			0
2	F		A		F	2.8
3	F	B	A	B	F	6.3
4	F	E	A	E	F	4.0
5	F	C	A	C	F	4.5
6	D		A		D	5.0
7	D	B	A	B	D	8.8
8	D	E	A	E	D	6.5
9	D	C	A	C	D	7.0
10	C	C	A	C	C	3.2
11	C	B	A	B	C	5.2
12	B	E	A	E	B	5.0
13	C	E	A	E	C	2.5
14		B	A	B		3.1
15		E	A	E		1.0
16	C		A		C	1.4
17	B		A		B	3.2
18		C	A	C		1.3
19	B	B	A	B	B	7.7
20	B	C	A	C	B	5.3

A UNIVERSAL TURRET
(M-197 20MM AUTOMATIC GUN)

B ROCKET LAUNCHER – M200A1
19 TUBE M261

CAUTION

The 19 tube rocket launcher is restricted to a maximum of twelve (12) seventeen (17) pound warhead rockets when mounted on outboard pylons. Refer to Chapter 6 for restrictions on other combinations.

C ROCKET LAUNCHER – M158
7 TUBE M260

D TOW MISSILE –
M65 – TWO LAUNCHERS

E WING GUN POD – M18 OR M18A1
(7.62MM GUN)

F TOW MISSILE
M65 – ONE LAUNCHER

Figure 7-8. Drag chart

SECTION VIII. CLIMB — DESCENT

7-30. DESCRIPTION — CLIMB-DESCENT CHART.

The upper grid of the climb descent chart (figure 7-9) shows the change in torque (above or below torque required for level flight under the same gross weight and atmospheric conditions) to obtain a given rate of climb or descent.

7-31. USE OF CLIMB-DESCENT CHART.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the upper grid scale must be added to the torque required for level flight (for climb) - or subtracted from the torque required for level flight (for descent) - obtained from the appropriate cruise chart in order to obtain a total climb or descent torque.

b. By entering the bottom of the upper grid with a known torque change, moving upward to the gross weight, and left to the corresponding rate of climb or descent may also be obtained.

NOTE

> **Torque available data shown in figures 7-3, 7-4, and 7-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7-1.**

7-32. CONDITIONS.

The climb-descent chart is based on the use of 100 percent rpm.

EXAMPLE B540

WANTED

EXCESS TORQUE AVAILABLE FOR CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

CLEAN CONFIGURATION

GROSS WEIGHT = 8000 LB

FAT = -30°C

PRESSURE ALTITUDE = 14000 FEET

METHOD

LOCATE CHART (FIGURE 7-7, SHEET 5)

FIND INTERSECTION OF 8000 LB GROSS WEIGHT

LINE WITH THE MAXIMUM RATE OF CLIMB LINE → ①

MOVE DOWN. READ TORQUE REQUIRED = 41.5% Q

FIND INTERSECTION OF 8000 LB GROSS WEIGHT

LINE WITH THE CONTINUOUS TORQUE AVAILABLE LINE → ②

MOVE DOWN. READ TORQUE AVAILABLE = 87% Q

EXCESS TORQUE AVAILABLE = (87 - 41.5) = 45.5% Q

WANTED

RATE OF CLIMB AT 60 KIAS

MAXIMUM CONTINUOUS POWER

KNOWN

EXCESS TORQUE AVAILABLE (FROM EXAMPLE ON FIGURE 7-7, SHEET 5) = 45.5% Q

GROSS WEIGHT = 8000 LB

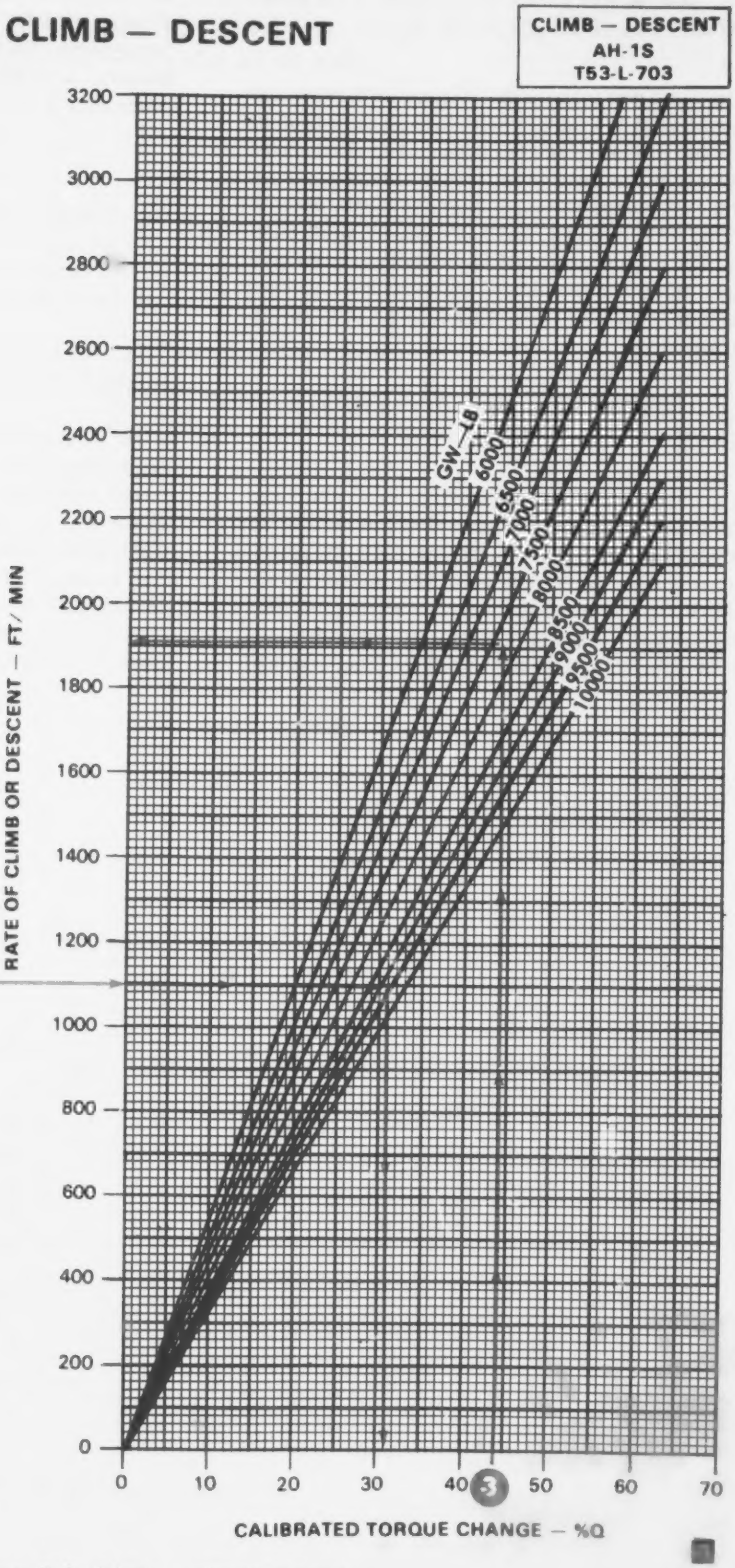
METHOD

ENTER CALIBRATED TORQUE SCALE HERE → ③

MOVE UP TO GROSS WEIGHT LINE

MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE. READ RATE OF CLIMB = 1900 FT/MIN

CLIMB — DESCENT



EXAMPLE

WANTED

CALIBRATED TORQUE CHANGE
FOR DESIRED R/C OR R/D

KNOWN OR ESTIMATED

GROSS WEIGHT = 9500 LB
DESIRED R/C = 1100 FT/MIN

METHOD

ENTER R/C HERE
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN, READ CALIBRATED
TORQUE CHANGE = 31% Q

DATA BASIS: DERIVED FROM FLIGHT TEST

B540 **Figure 7-9. Climb — descent chart**

7-33. DESCRIPTION — CLIMB PERFORMANCE CHART.

The climb performance chart (figure 7-10) represents a synthesis of the cruise charts to ease estimation of the climb portion of the flight plan. The chart shows relationships between gross weight, initial and final altitude and temperatures, and time to climb, distance covered while climbing, and fuel expended while climbing. The chart is presented for climbing at maximum torque (30-minute operation) and with 8 TOW configuration. However, this chart may be used for all configurations.

7-34. USE OF CLIMB PERFORMANCE CHART.

Enter at the top left at the known gross weight, move right to the initial altitude, move down to the free air temperature at that altitude, and move left and record time, distance, and fuel flow for that altitude. Enter again at the gross weight, move right to the final altitude, move down to the free air temperature at that altitude, and move right and record the time, distance, and fuel flow for that altitude. Subtract the time, distance, and fuel flow values of the initial altitude-temperature condition from those of the final altitude-temperature condition to find the time to climb, distance covered, and fuel used while climbing.

NOTE

Torque available data shown in figures 7-3, 7-4, and 7-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7-1.

7-35. CONDITIONS — CLIMB PERFORMANCE CHART.

The chart represents climb at optimum condition, that is minimum power required and maximum (30 minute) power available. Climb is assumed to be at 60 knots IAS as this is near the airspeed for maximum rate of climb at most atmospheric conditions. Warmup and taxi fuel are not included in fuel flow calculations. Climb performance is calculated for 100 percent rpm. The chart is based on a no-wind condition, therefore distance traveled will not be valid when winds are present.

CLIMB PERFORMANCE (MAXIMUM TORQUE -30 MINUTE OPERATION)

100% RPM CLIMB AT 60 KIAS

EXAMPLE

WANTED

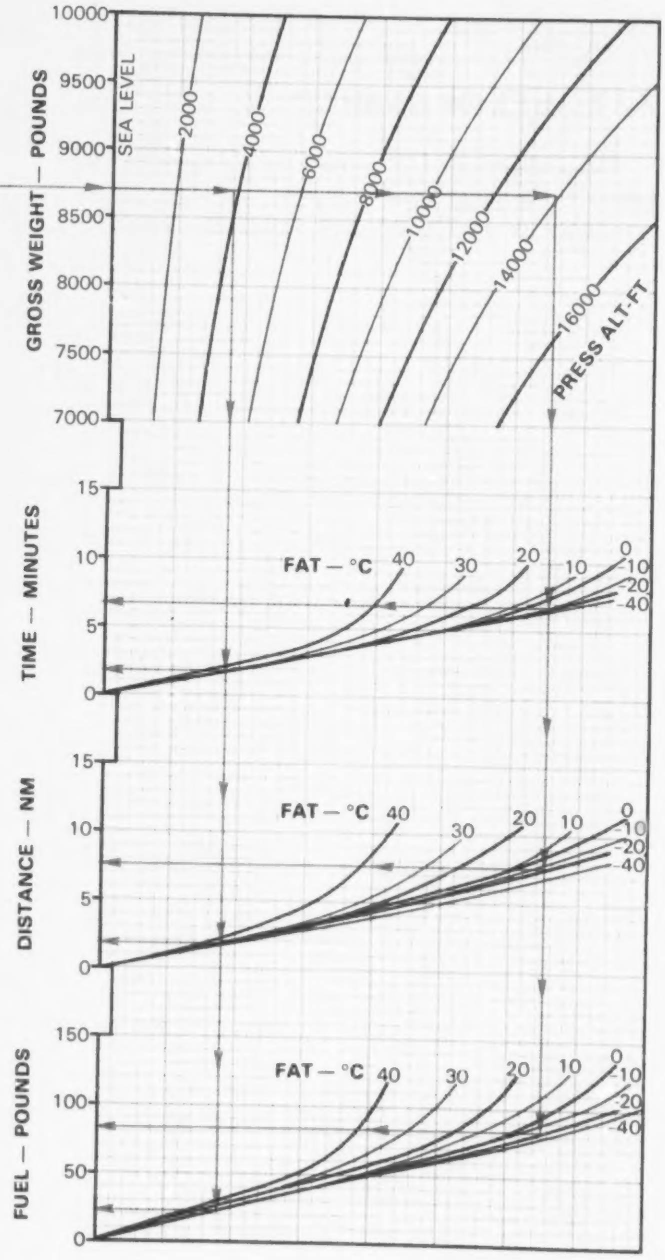
MAXIMUM POWER
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 8700 LBS
INITIAL PRESSURE ALTITUDE = 4000 FT
FINAL PRESSURE ALTITUDE = 14000 FT
INITIAL FAT = 0°C
FINAL FAT ESTIMATED AT -20°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 1.8 MIN
DISTANCE = 1.8 NM
FUEL = 23 LB
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FINAL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 6.7 MIN
DISTANCE = 7.6 NM
FUEL = 83 LB
TIME TO CLIMB = (6.7 - 1.8) = 4.9 MIN
DISTANCE COVERED = (7.6 - 1.8) = 5.8 NM
FUEL USED = (83 - 23) = 60 LB



DATA BASIS: DERIVED FROM FLIGHT TEST USA ASTA 66-06, APRIL 1970

B540 Figure 7-10. Climb performance (Maximum torque — 30 minute operation) chart

SECTION IX. IDLE FUEL FLOW

7-36. DESCRIPTION.

The idle fuel flow chart (figure 7-11) shows the fuel flow at engine idle and at flat pitch with 100 percent rpm.

7-37. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the idle fuel flow, it is necessary to know the idle condition, pressure altitude, and free air temperature. Enter at the pressure altitude, move right to FAT in appropriate grid, then move down and read fuel flow on the scale corresponding to the condition. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7-38. CONDITIONS.

This chart is based on the use of JP-4 fuel.

IDLE FUEL FLOW

JP-4 FUEL

IDLE FUEL FLOW
AH-1S
T53-L-703

EXAMPLE

WANTED

FUEL FLOW AT ENGINE IDLE AND AT 100% RPM WITH FLAT PITCH

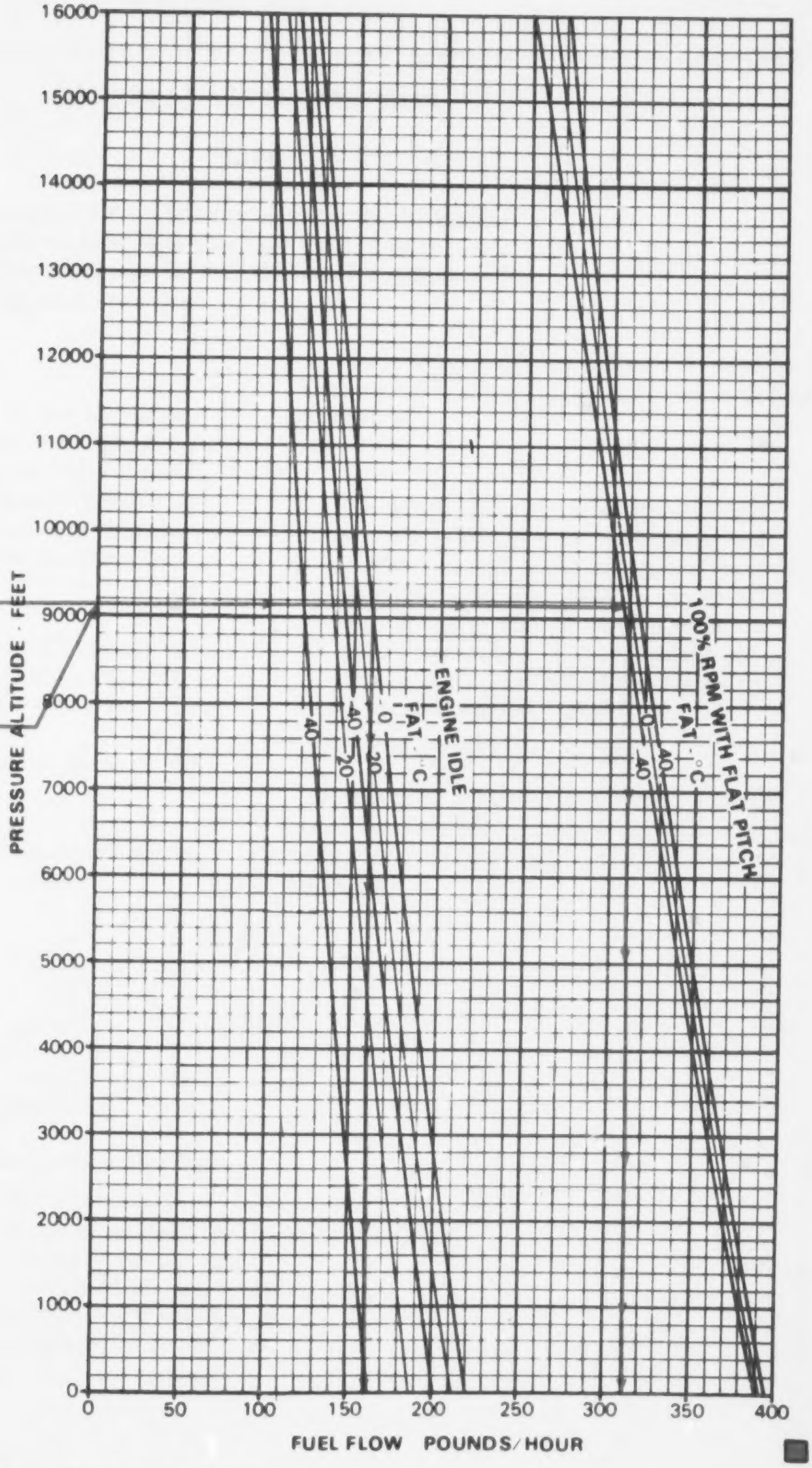
KNOWN

PRESSURE ALTITUDE = 9200 FEET
FAT = 0°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (ENGINE IDLE) FAT
MOVE DOWN, READ ENGINE IDLE
FUEL FLOW = 160 LB/HR

REENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (100% RPM WITH FLAT PITCH) FAT
MOVE DOWN, READ 100% RPM WITH FLAT PITCH
FUEL FLOW = 310 LB/HR



DATA BASIS: CALCULATED

Figure 7-11 Idle fuel flow chart

CHAPTER 7.1

PERFORMANCE DATA

SECTION I. INTRODUCTION

NOTE

Chapter 7.1 provide information for the AH-1P/E/F equipped with K747 main rotor blade. Chapter 7 provides information for the AH-1P/E/F equipped with B540 main rotor blade.

7.1-1. PURPOSE.

The purpose of this chapter is to provide the best available performance data for the AH-1P/E/F helicopter. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons.

a. Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

b. Situations requiring maximum performance will be more readily recognized.

c. Familiarity with the data will allow performance to be computed more easily and quickly.

d. Experience will be gained in accurately estimating the effects of variables for which data are not presented.

NOTE

The information provided in this chapter is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used inflight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7.1-2. CHAPTER 7.1 INDEX.

The following index contains a list of the sections and their titles, the figure numbers, subjects and page numbers of each performance data chart contained in this chapter.

INDEX

SECTION SUBJECT PAGE NO.

I INTRODUCTION 7.1-1

II PERFORMANCE PLANNING 7.1-5

Figure 7.1-1 Deleted

Figure 7.1-2 Temperature Conversion Chart 7.1-9

III TORQUE AVAILABLE 7.1-10

Figure 7.1-3 Maximum Torque Available (30-Minute Operation) Chart Engine Deice — Off and ECS Off 7.1-11

Figure 7.1-4 Torque Available (Continuous Operation) Chart

Sheet 1 of 2 Engine Deice — Off and ECS Off 7.1-12

Sheet 2 Engine Deice — Off and ECS On 7.1-13

INDEX (Cont)

SECTION SUBJECT PAGE NO.

IV HOVER 7.1-14

Figure 7.1-5 Hover Chart
Sheet 1 of 2 Hover Ceiling 7.1-15
Sheet 2 Hover Torque Required 7.1-17

V TAKEOFF 7.1-18

Figure 7.1-6 Takeoff Chart 7.1-19

VI CRUISE 7.1-20

Figure 7.1-7 Cruise Chart
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Sheet 2 2000 Ft 7.1-22
Sheet 3 4000 Ft to 6000 Ft 7.1-23
Sheet 4 8000 Ft to 10000 Ft 7.1-24
Sheet 5 12000 Ft to 14000 Ft 7.1-25
Sheet 6 = -15°C, Sea Level to 2000 Ft 7.1-26
Sheet 7 4000 Ft to 6000 Ft 7.1-27
Sheet 8 8000 Ft to 10000 Ft 7.1-28
Sheet 9 12000 Ft to 14000 Ft 7.1-29
Sheet 10 = 0°C, Sea Level to 2000 Ft 7.1-30
Sheet 11 4000 Ft to 6000 Ft 7.1-31
Sheet 12 8000 Ft to 10000 Ft 7.1-32
Sheet 13 12000 Ft to 14000 Ft 7.1-33
Sheet 14 = +15°C, Sea Level to 2000 Ft 7.1-34
Sheet 15 4000 Ft to 6000 Ft 7.1-35
Sheet 16 8000 Ft to 10000 Ft 7.1-36
Sheet 17 12000 Ft to 14000 Ft 7.1-37
Sheet 18 = +30°C, Sea Level to 2000 Ft 7.1-38
Sheet 19 4000 Ft to 6000 Ft 7.1-39
Sheet 20 8000 Ft to 10000 Ft 7.1-40
Sheet 21 = +45°C, Sea Level to 2000 Ft 7.1-41
Sheet 22 4000 Ft to 6000 Ft 7.1-42
Sheet 23 8000 to 10000 Ft 7.1-43

VII DRAG 7.1-44

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VIII CLIMB-DESCENT 7.1-46
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Figure 7.1-10 Climb Performance Chart 7.1-49

IX IDLE FUEL FLOW 7.1-50

Figure 7.1-11 Idle Fuel Flow Chart 7.1-51

7.1-3. GENERAL.

The data presented covers the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data are presented at conservative conditions. However, NO GENERAL CONSERVATISM HAS BEEN APPLIED. All performance data presented are within the applicable limits of the aircraft.

7.1-4 LIMITS.

Applicable limits are shown on the charts as red lines. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7.1-5 USE OF CHARTS.

a. Chart Explanation. The first page of each section describes the chart(s) and explains its uses.

b. Color Coding. Chart color codes are used as follows:

(1) Green is used for example guidelines.

(2) Red is used for limit lines.

(3) Yellow is used for precautionary or time-limited operation.

c. Reading the Charts. The primary use of each chart is given in an example and a green guideline is provided to help you follow the route through the chart. The use of a straight edge (ruler or page edge) and a hard fine point pencil is recommended to avoid cumulative errors. The majority of the charts provide a standard pattern for use as follows: enter first variable on top left scale, move right to the second variable, reflect down at right angles to the third variable, reflect left at right angles to the fourth variable, reflect down, etc until the final variable is read out at the final scale. In addition to the primary use, other uses of each chart are explained in the text accompanying each set of performance charts. Colored registration blocks located at the bottom and top of each chart are used to determine if slippage has occurred during printing. If slippage has occurred, refer to Chapter 5 for correct operating limits.

NOTE

An example of an auxiliary use of the charts referenced above is as follows: Although the hover chart is primarily arranged to find torque required to hover, by entering torque available as torque required, maximum skid height for hover can also be found. In general, any single variable can be found if all others are known. Also, the tradeoffs between two variables can be found. For example, at a given pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

7.1-6. DATA BASIS.

The type of data used is indicated at the bottom of each performance chart under DATA BASIS. The applicable report and date of the data are also given. The data provided generally is based on one of four categories:

a. Flight Test Data. Data obtained by flight test of the aircraft by experienced flight test personnel at precise conditions using sensitive calibrated instruments.

b. Derived From Flight Test. Flight test data obtained on a similar rather than the same aircraft and series. Generally small corrections will have beem made.

c. Calculated Data. Data based on tests, but not on flight test of the complete aircraft.

d. Estimated Data. Data based on estimates having aerodynamic theory or other means but not verified by flight test.

7.1-7. SPECIFIC CONDITIONS.

The data presented are accurate only for specific conditions listed under the title of each chart. Variables for which data are not presented, but which may affect that phase of performance, are discussed in the text. Where data are available or reasonable estimates can be made, the amount that each variable affects performance will be given.

7.1-8. GENERAL CONDITIONS.

In addition to the specific conditions, the following general conditions are applicable to the performance data.

a. **Rigging.** All airframe and engine control are assumed to be rigged within allowable tolerances.

b. **Pilot Technique.** Normal pilot technique is assumed. Control movements should be smooth and continuous.

c. **Aircraft Variation.** Variations in performance between individual aircraft are known to exist; however, they are considered to be small and cannot be individually accounted for.

d. **Instrument Variation.** The data shown in the performance charts do not account for instrument inaccuracies or malfunctions.

7.1-9. PERFORMANCE DISCREPANCIES.

Regular use of this chapter will allow you to monitor instruments and other aircraft systems for malfunction, by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data are not provided, thereby increasing the accuracy of performance predictions.

7.1-10. DEFINITIONS OF ABBREVIATIONS.

a. Unless otherwise indicated in Appendix B, abbreviations and symbols used in this manual conform to those established in Military Standard MIL-STD-12, which is periodically revised to reflect current changes in abbreviations usage. Accordingly, it may be noted that certain previously established definitions have been replaced by more current abbreviations and symbols.

b. Capitalization and punctuation of abbreviations varies, depending upon the context in which they are used. In general, lower case abbreviations are used in text material, whereas abbreviations used in charts and illustrations appear in full capital letters. Periods do not usually follow abbreviations; however, periods are used with abbreviations that could be mistaken for whole words if the period were omitted.

SECTION II. PERFORMANCE PLANNING

7.1-11. PERFORMANCE PLANNING.

Refer to FC1-213 Aircrew Training Manual for preparing the performance planning card (PPC).

7.1-12. TEMPERATURE CONVERSION.

The temperature conversion chart (figure 7.1-2) is arranged so that degrees celsius can be converted quickly and easily by reading celsius and looking directly across the chart for fahrenheit equivalent and vice versa.

All data on pages 7.1-6 thru 7.1-7/7.1-8, including figure 7.1-1 and paragraph 7.1-13 is deleted.

TEMPERATURE CONVERSION CHART

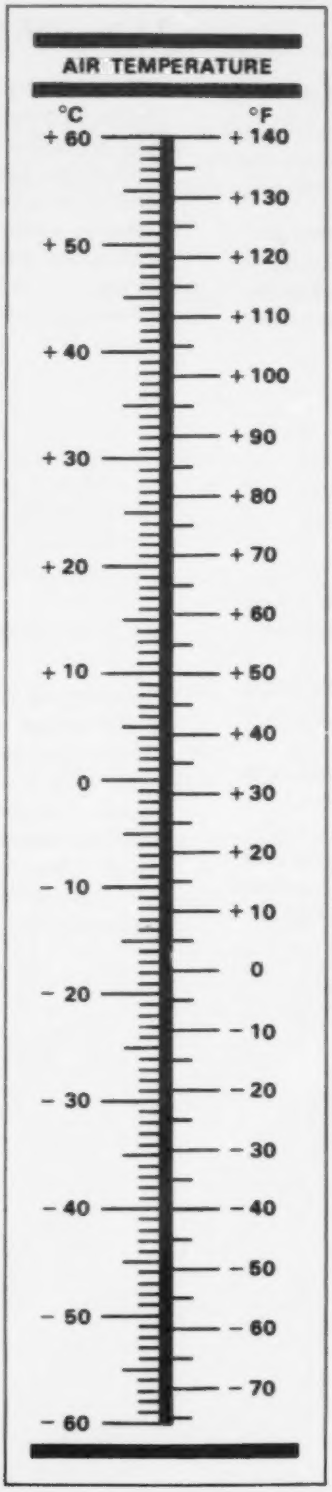


Figure 7.1-2. Temperature Conversion Chart

best copy available

SECTION III. TORQUE AVAILABLE

7.1-14. DESCRIPTION.

The torque available charts show the effects of altitude and temperature on engine torque.

7.1-15. CHART DIFFERENCES.

Both pressure altitude and FAT affect engine power production. Figures 7.1-3 and 7.1-4 show power available data at 30 minute power and maximum continuous power ratings in terms of the allowable torque as recorded by the torquemeter (% Q).

CAUTION

> The power output capability of the T53-L-703 engine can exceed the transmission structural limit (100 % Q) under certain conditions.

a. Figure 7.1-3 is applicable for maximum power, engine deice off and ECS off 30 minute operation.

b. Figure 7.1-4 (sheet 1) is applicable for maximum continuous power, engine deice off, and ECS off.

c. Figure 7.1-4 (sheet 2) is applicable for maximum continuous power, engine deice off and ECS on.

d. Prolonged IGE hover may increase engine inlet temperature as much as 10 degrees Celsius, therefore, a higher FAT must be used to correct for the increase under this condition.

7.1-16. USE OF CHARTS.

The primary use of the charts is illustrated by the examples. In general, to determine the maximum power available, it is necessary to know the pressure altitude, temperature, and the aircraft calibration factor. By entering the upper left side of the chart at the known pressure altitude, moving right to the known temperature, then straight down to the calibrating factor line, then move left to the indicated torque scale and read an indicated torque available.

NOTE

> Torque available data shown in figures 7.1-3, 7.1-4, and 7.1-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7.1-1.

7.1-17. CONDITIONS.

Charts (figure 7.1-3 and 7.1-4) are based upon speeds at 100 percent rpm with grade JP-4 fuel. The use of aviation gasoline will not influence engine power. Fuel grade of JP-5 will yield the same nautical miles per pound of fuel and being 6.8 pounds per gallon will only result in increased fuel weight per gallon. Because JP-4 and JP-5 have the same energy value per pound, the JP-5 fuel will increase range by almost 5 percent per gallon of fuel.

Interim Table 7.1-1. Performance Data Correction Information

As an interim measure, this table is provided until such time as performance charts can be corrected.

With the IR suppressor installed, the equivalent flat plate drag area will be increased by 2 sq. ft. and fuel flow will be increased by up to 4%.

Hover performance should be determined using sheet 2 of figure 7.1-5 and climb performance should be determined using figure 7.1-9. Sheet 1 of figure 7.1-5 and figure 7.1-10 are based on the torque available shown in figure 7.1-3 and do not accurately reflect the hover ceiling and climb capability of the helicopter.

	FAT	Pressure Altitude - Feet							
	°C	0	2000	4000	6000	8000	10000	12000	14000
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	- - -	- - -	5½	5
For Max.	-15	- - -	- - -	- - -	- - -	- - -	6	4½	3
Torque Avail.	0	- - -	- - -	- - -	6	6	5	4½	4
(30 Min.)	15	- - -	6	4½	4	4	3½	4½	6
W/O IR	30	4½	4	3½	4	2½	1½	2½	5½
Suppressor	45	5	3½	4	5	4½	4	4½	6½
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	- - -	8½	7½	7
For Max.	-15	- - -	- - -	- - -	- - -	9	9	8	7
Torque Avail.	0	- - -	- - -	9½	9½	9½	9	9	8½
(30 Min.)	15	12½	12½	9½	9½	9	8	9	10½
With IR	30	12½	11	10	10	8½	6½	7	9½
Suppressor	45	13	11	11½	11½	10½	9½	9	10
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	4½	4	3	2½
For Cont.	-15	- - -	- - -	- - -	4½	4	4	3½	3½
Torque Avail.	0	5	4½	4	3½	3½	3½	4½	4½
W/O IR	15	4	4	3½	3	3	2½	3	3½
Suppressor	30	4½	4	4	4	2½	½	0	0
	45	4½	4	4	5	4	3½	2½	2
Δ % Q									
Correction	-30	- - -	- - -	- - -	- - -	9	8	7	6
For Cont.	-15	- - -	- - -	10½	9½	9	8½	8	7½
Torque Avail.	0	12	11	10	9	8½	8½	8½	8½
With IR	15	11½	11	10	9	8½	7½	8	7½
Suppressor	30	11½	10½	10	10	8	5½	4	2
	45	11½	10	10	10	9½	8	6½	5

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ENGINE DEICE OFF, ECS OFF

100% RPM JP-4 FUEL

MAXIMUM TORQUE
AH-1S
T53-L-703

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

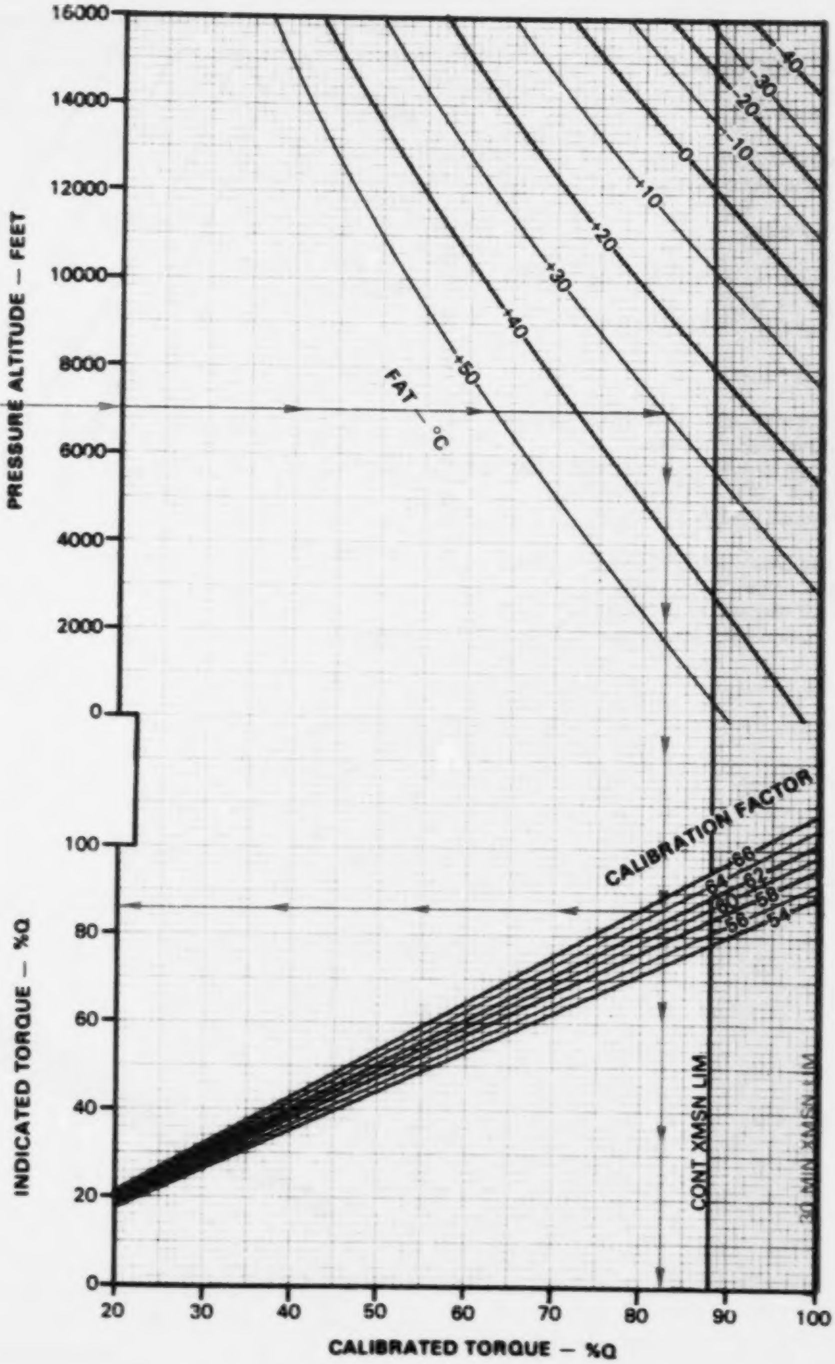
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 30°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED
TORQUE = 86.0 %Q

FOR CALIBRATED TORQUE
CONTINUE DOWN THRU
CALIBRATION FACTOR, READ
CALIBRATED TORQUE = 82.2 %Q



DATA BASIS: CALCULATED

Figure 7.1-3. Maximum Torque Available (30 Minute Operation) Chart

TORQUE AVAILABLE (CONTINUOUS OPERATION)

ENGINE DEICE OFF, ECS OFF

100% RPM JP-4 FUEL

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

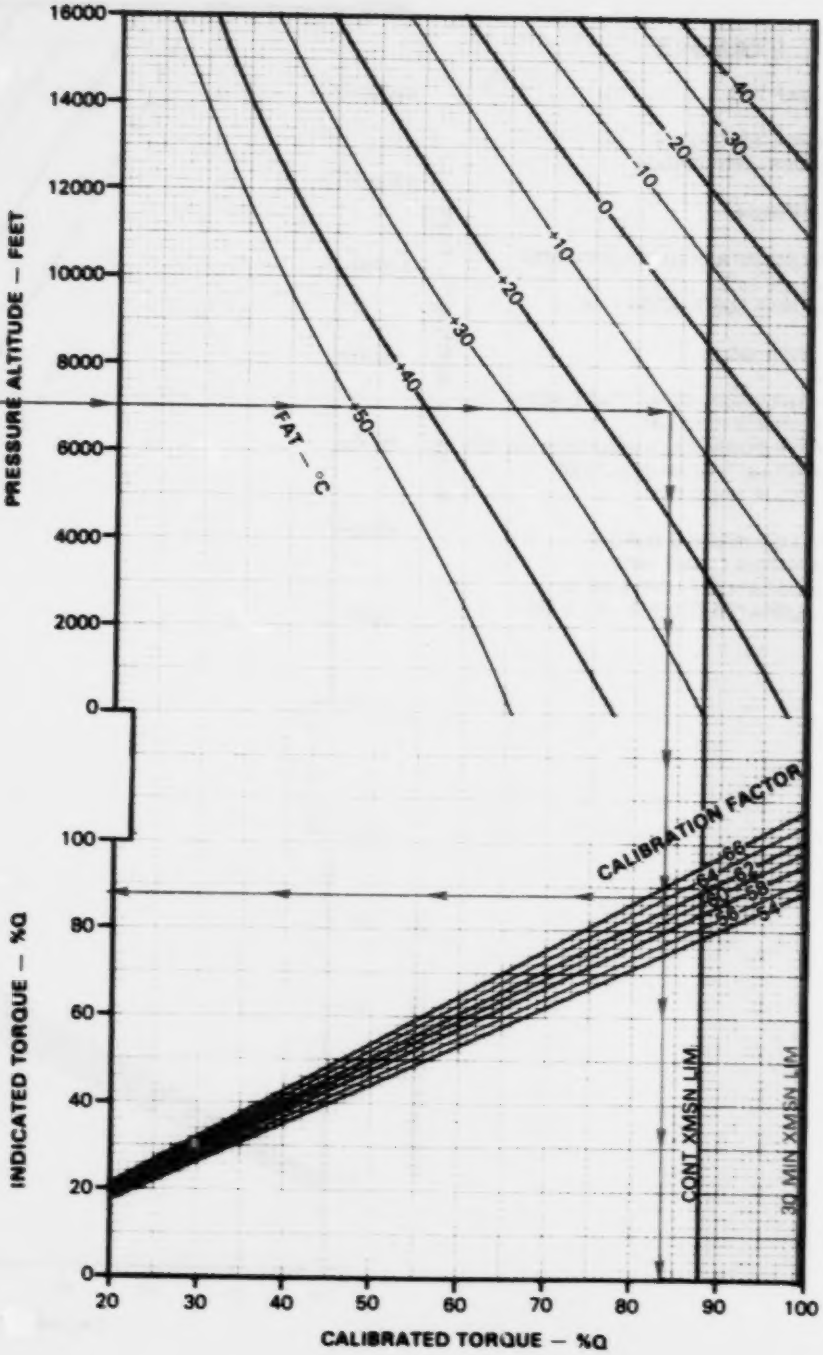
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED
TORQUE = 88.0 % Q

FOR CALIBRATED TORQUE
CONTINUE DOWN THRU
CALIBRATION FACTOR, READ
CALIBRATED TORQUE = 84.2 %Q



DATA BASIS: CALCULATED

Figure 7.1-4. Torque Available (Continuous Operation) Chart (Sheet 1 of 2)

TORQUE AVAILABLE (CONTINUOUS OPERATION)

ENGINE DEICE OFF, ECS ON

100% RPM JP-4 FUEL

TORQUE AVAILABLE
AH-1S
T53-L-703

EXAMPLE

WANTED

INDICATED TORQUE
CALIBRATED TORQUE

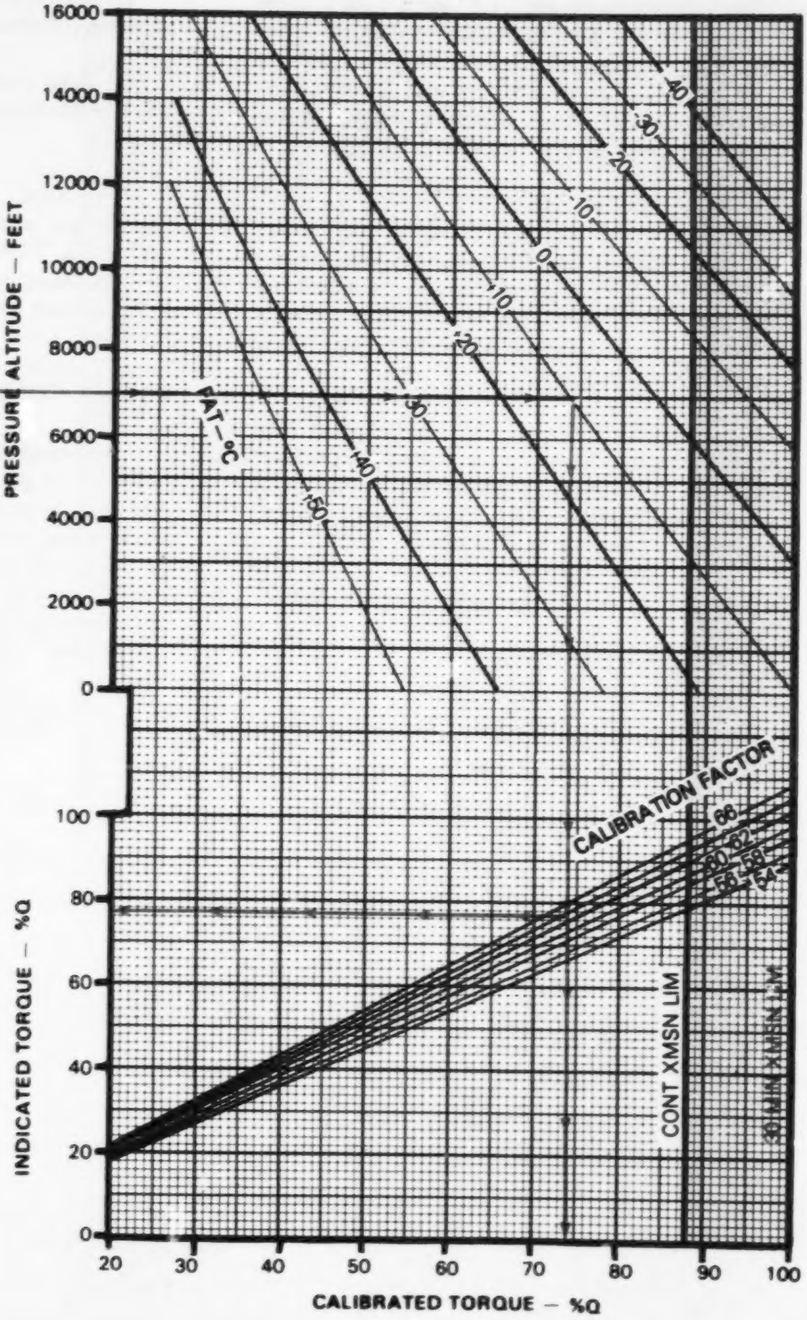
KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = + 10°C
CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT, READ INDICATED
TORQUE = 77.0 % Q

FOR CALIBRATED TORQUE
CONTINUE DOWN THRU
CALIBRATION FACTOR, READ
CALIBRATED TORQUE = 73.8 % Q



DATA BASIS: CALCULATED

Figure 7.1-4. Torque Available (Continuous Operation) Chart (Sheet 2 of 2)

SECTION IV. HOVER

7.1-18. DESCRIPTION.

The hover charts (figure 7.1-5, sheets 1 and 2) show the hover ceiling and the torque required to hover respectively at various pressure altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available from figure 7.1-3.

7.1-19. USE OF CHART.

a. The primary use of the charts is illustrated by the charts examples. In general, to determine the hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight and the desired skid height.

b. In addition to its primary use, the hover chart (sheet 2) can also be used to determine the predicted maximum hover height, which is needed for use of the takeoff chart (figure 7.1-6). To determine maximum hover height, proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight.

(4) Move left to intersection with maximum power available (obtained from figure 7.1-3).

(5) Read predicted maximum skid height. This height is the maximum hover height.

NOTE

Torque available data shown in figures 7.1-3, 7.1-4, and 7.1-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7.1-1.

7.1-20. CONDITIONS.

The hover charts are based upon calm wind conditions, a level ground surface, and the use of 100 percent rpm. In ground effect hover data is based upon hovering over a level surface. If the surface over which hovering will be conducted is known to be steep, uneven, covered with high vegetation, or if the type of terrain is unknown, the flight should be planned for out of ground effect hover capability.

■G

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
100% RPM

HOVER
CEILING
AH-1S
T53-L-703

EXAMPLE

WANTED

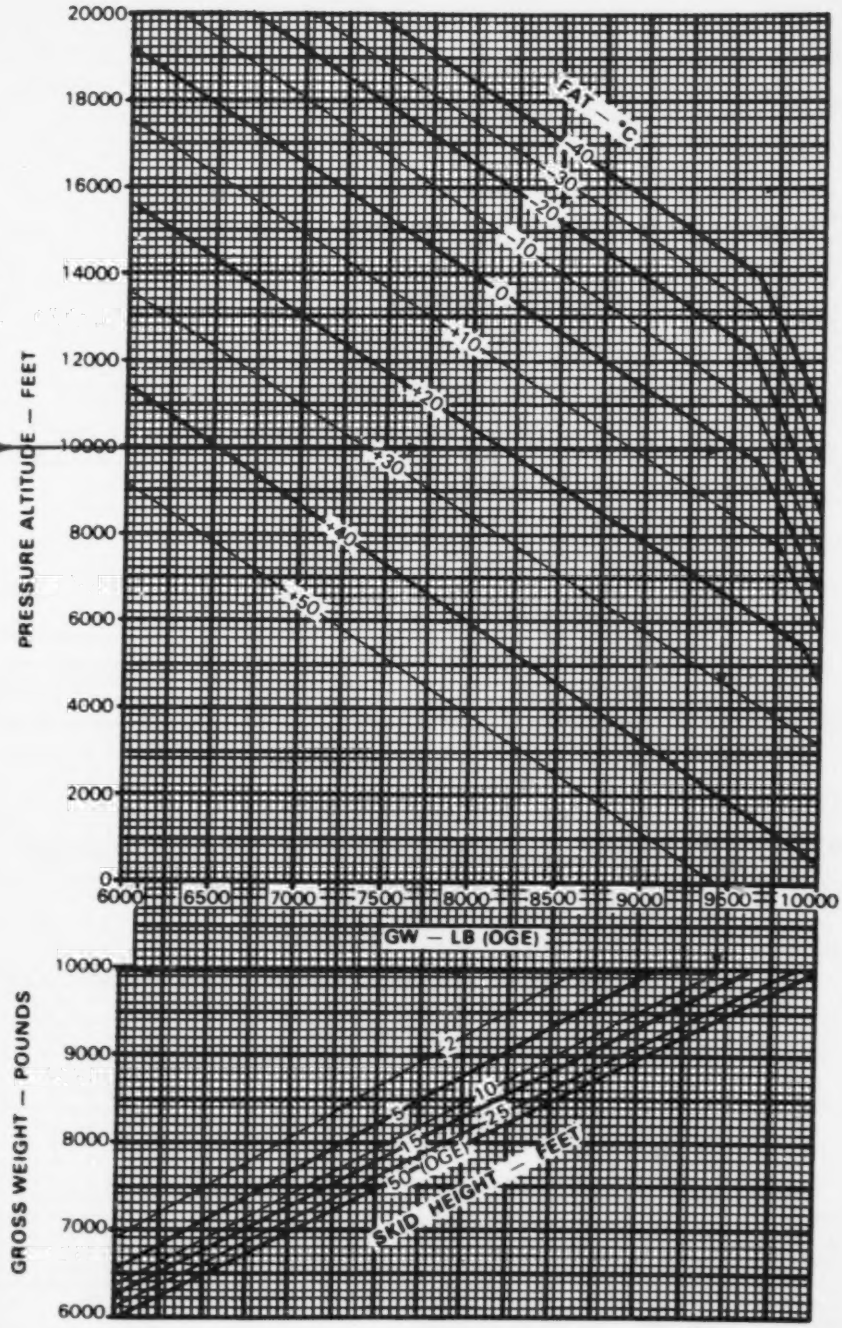
GROSS WEIGHT TO HOVER

KNOWN

PRESSURE ALTITUDE = 10000 FEET
FAT = 0°C
SKID HEIGHT = 10 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE →
MOVE RIGHT TO FAT
MOVE DOWN TO SKID HEIGHT
MOVE LEFT, READ GROSS WEIGHT
TO HOVER = 10000 POUNDS



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-5. Hover Ceiling Chart (Sheet 1 of 2)

G■

EXAMPLE K747

WANTED

MAXIMUM GROSS WEIGHT TO HOVER AT OGE

KNOWN (REFERENCE EXAMPLE FOR FIGURE 7.1-3)

30 MINUTE CALIBRATED TORQUE AVAILABLE = 82% Q

PRESSURE ALTITUDE = 7000 FEET

FAT = +30°C

CALIBRATION FACTOR = 64

METHOD

ENTER PRESSURE ALTITUDE HERE → ①

MOVE RIGHT AND INTERPOLATE FOR +30°C FAT

MOVE DOWN AND READ DENSITY ALTITUDE = 10000 FEET

ENTER CALIBRATED TORQUE HERE → ②

MOVE UP TO INTERSECT OGE LINE

MOVE RIGHT TO INTERSECT THE VERTICAL

LINE FROM ① AND READ GROSS WEIGHT TO HOVER = 8700 POUNDS

G■
R■
Y☐

HOVER

ALL CONFIGURATIONS 100% RPM
LEVEL SURFACE CALM WIND

HOVER
AH-1S
T53-L-703

EXAMPLE

WANTED

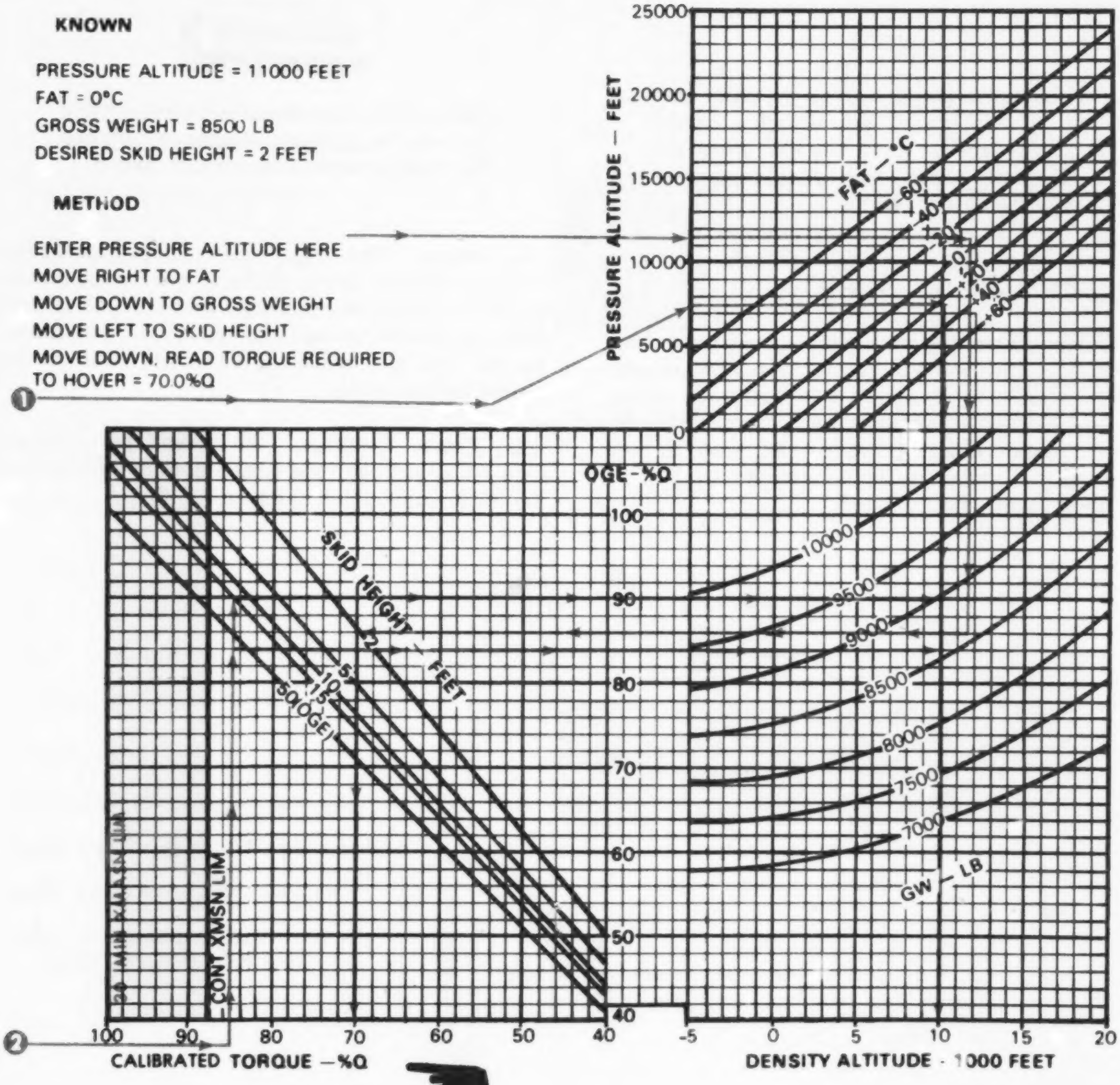
TORQUE REQUIRED TO HOVER

KNOWN

PRESSURE ALTITUDE = 11000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 LB
DESIRED SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT
MOVE LEFT TO SKID HEIGHT
MOVE DOWN, READ TORQUE REQUIRED
TO HOVER = 70.0%Q



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-5. Hover Ceiling Chart (Sheet 2 of 2)

■G
■R
☐Y

SECTION V. TAKEOFF

7.1-21. DESCRIPTION.

The takeoff chart (figure 7.1-6) shows the distances to clear various obstacle heights, based upon several hover height capabilities. The upper chart grid presents data for climbout at a constant 35 knots INDICATED airspeed. The two lower grids present data for climbouts at various TRUE airspeeds.

NOTE

The hover heights shown on the chart are only a measure of the aircraft's climb capability and do not imply that a higher than normal hover height should be used during the actual takeoff.

7.1-22. USE OF CHART.

The primary use of the chart is illustrated by the chart examples. The main consideration for takeoff performance is the hovering skid height capability, which includes the effects of pressure altitude, free air temperature, gross weight, and torque. Hover height capability is determined by use of the hover chart, figure 7.1-5.

A hover check can be made to verify the hover capability. If winds are present, the hover check may disclose that the helicopter can actually hover at a greater skid height than the calculated value, since the hover chart is based upon calm wind conditions.

7.1-23. CONDITIONS.

WARNING

A tailwind during takeoff and climbout will increase the obstacle clearance distance and could prevent a successful takeoff.

a. **Wind.** The takeoff chart is based upon calm wind conditions. Since surface wind velocity and direction cannot be accurately predicted, all takeoff planning should be used upon calm wind conditions. Takeoff into any prevailing wind will improve the takeoff performance.

b. **Power Settings.** All takeoff performance data are based upon the torque used in determining the hover capabilities in figure 7.1-6.

TAKEOFF

LEVEL ACCELERATION TECHNIQUE 3 FT SKID HEIGHT

TAKEOFF
AH-1S
T53-L-703

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAXIMUM HOVER HEIGHT 10 FEET
OBSTACLE HEIGHT 50 FEET

METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO OBSTACLE HEIGHT

MOVE DOWN, READ DISTANCE TO CLEAR OBSTACLE 825 FEET

EXAMPLE B

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT 8 FEET

OBSTACLE HEIGHT 50 FEET

CLIMBOUT AIRSPEED 40 KNOTS

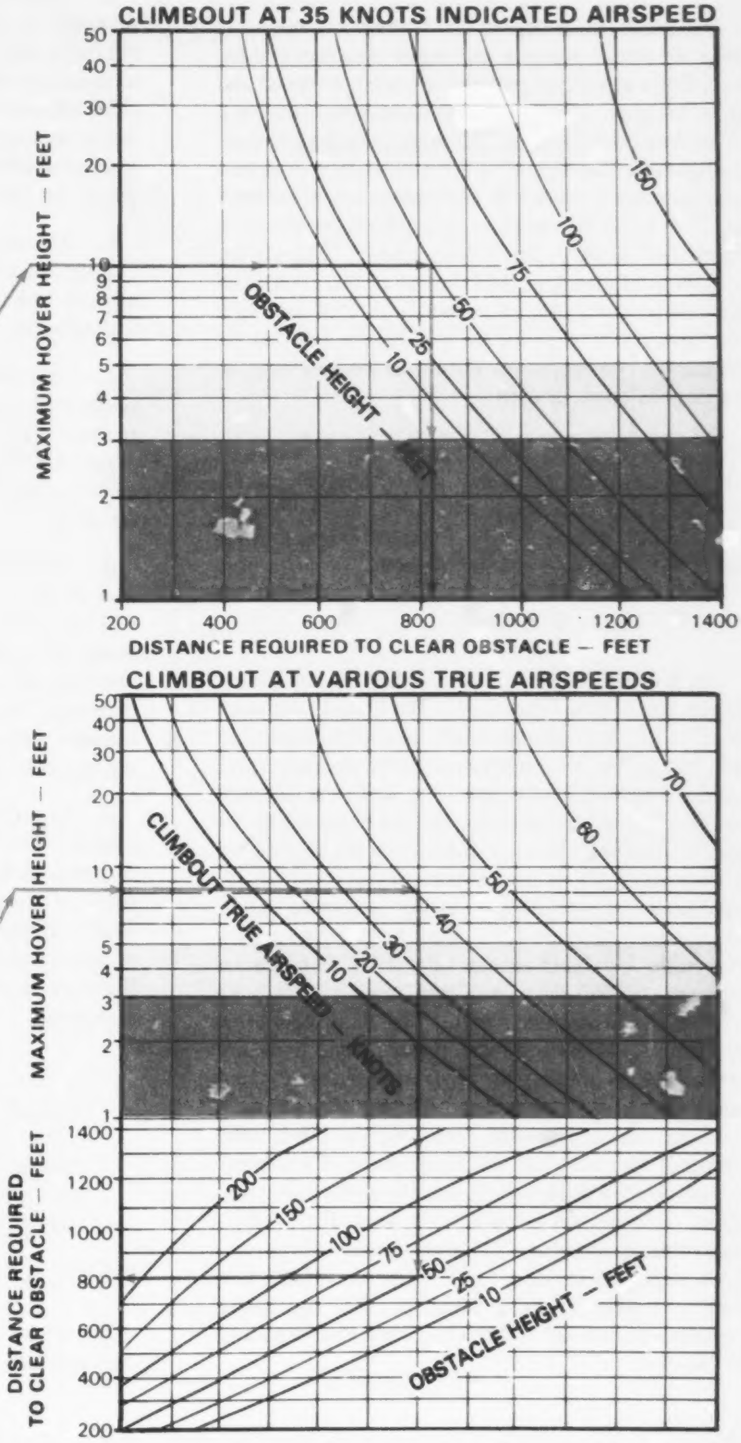
METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO CLIMBOUT TRUE AIRSPEED

MOVE DOWN TO OBSTACLE HEIGHT

MOVE LEFT READ DISTANCE TO CLEAR OBSTACLE 800 FEET



DATA BASIS: ESTIMATED DATA

K747 **Figure 7.1-6. Takeoff Chart**

SECTION VI. CRUISE

7.1-24. DESCRIPTION.

The cruise charts (figure 7.1-7, sheet 1 through 23) show the torque pressure and engine rpm required for level flight at various pressure altitudes, airspeed and gross weights. The cruise charts are presented for a clean drag configuration. However, any desired drag configuration (see figure 7.1-7 for authorized armament configurations) can be solved by using a ratio between the ☐ % Q for the desired configuration (as shown in figure 7-7, sheets 1 thru 23) and the ☐ % Q for the 8 TOW configuration. Add the calculated ☐ % Q of the desired configuration to the ☐ % Q of the clean configuration to solve for the total torque required for the desired configuration. Then read the fuel flow for the desired configuration.

Thus, the effects of added drag resulting from installed wing stores can be determined by applying the ☐ F — SQ FT from the Drag Chart (figure 7.1-8) to the cruise charts (figure 7.1-7). Refer to Example B on figure 7.1-7, sheet 1 for the method.

7.1-25. USE OF CHARTS.

The primary use of the charts is illustrated by the examples provided in figure 7.1-7. The first step for chart use is to select the proper chart, pressure altitude and anticipated free air temperature; refer to chapter 7.1 index (paragraph 7.1-2). Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude and FAT. If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (see figure 7.1-7, sheet 1, example A). You may enter the charts on any side: TAS, IAS, torque pressure, or fuel flow, and then move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight; then read airspeed, fuel flow and torque pressure. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights it is preferable to determine cruise information for several flight segments in order to allow for decreasing fuel weight (reduced gross weight). The following parameters contained in each chart are further explained as follows:

a. **Airspeed.** True and indicated airspeed are presented at opposite sides of each chart. On any chart, indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (V_{NE}) limits appear as red lines on some charts. If no red line appears, (V_{NE}) is above the limits of the chart.

b. **Torque Pressure (% Q).** Since pressure altitude and temperature are fixed for each chart, torque pressure required varies according to gross weight and airspeed.

c. **Fuel Flow.** Fuel flow scales are provided opposite the torque pressure scales. On any chart, torque pressure may be converted directly to fuel flow without regard for other chart information. All fuel flow information is presented ECS off. Add 4 percent fuel flow for ECS on.

d. **Maximum Range.** The maximum range lines indicate the combination of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart it is because the maximum range speed is beyond the maximum permissible speed (VNE); in such cases, use VNE cruising speed to obtain maximum range.

e. **Maximum Endurance and Rate of Climb.** The maximum endurance and rate of climb line indicate the airspeed for minimum torque pressure required to maintain level flight for each gross weight, FAT and pressure altitude. Since minimum torque pressure will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeeds indicated.

NOTE

Torque available data shown in figures 7.1-3, 7.1-4, and 7.1-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7.1-1.

7.1-26. CONDITIONS.

The cruise charts are based on operation at 100 percent rpm and ECS off.

CRUISE

PRESSURE ALTITUDE — SEA LEVEL

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = -30°C

EXAMPLE A

WANTED

TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

CLEAN CONFIGURATION, GROSS WEIGHT = 8000 LB, PRESSURE ALTITUDE = 1000 FEET, FAT = -30°C, DESIRED TRUE AIRSPEED = 110 KNOTS.

METHOD (INTERPOLATE)

ENTER TRUE AIRSPEED HERE
READ TORQUE, FUEL FLOW, AND IAS ON EACH ADJACENT ALTITUDE AND/OR FAT, THEN INTERPOLATE BETWEEN ALTITUDE AND FAT

SEE FIGURE 7.1-7 (SHT 2) ①

ALTITUDE, FEET	SEA LEVEL	2000 FEET	1000 FEET
FAT, °C	-30	-30	-30
TORQUE, % Q	66.2	63.0	64.6
FUEL FLOW, LB/HR	615	580	597.5
IAS, KNOTS	124	119	121.5

EXAMPLE B

WANTED

ADDITIONAL TORQUE REQUIRED AND FUEL FLOW FOR ARMAMENT CONFIGURATION AND CONDITION IN EXAMPLE A

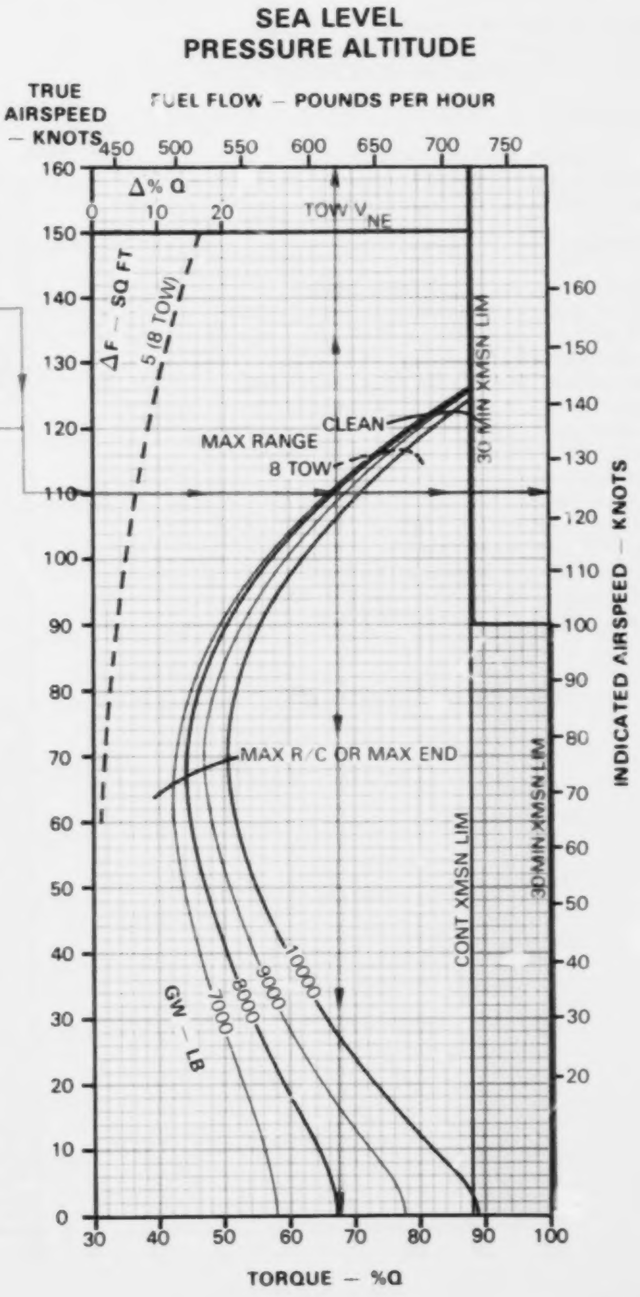
KNOWN

ARMAMENT CONFIGURATION FOR 2 19 TUBE ROCKET LAUNCHERS = 3.1 ΔF -SQ FT (FROM FIGURE 7.1-8)

METHOD

ENTER TRUE AIRSPEED AT 110 KNOTS AND MOVE RIGHT TO ΔF - SQ FT = 3.1 (BETWEEN 0.0 AND 5.0 ΔF - SQ FT). FROM THAT POINT MOVE UP TO READ 3.7% Q TORQUE. ADD 3.7% Q TORQUE TO THE TORQUE REQUIRED FOR LEVEL FLIGHT IN THE CLEAN CONFIGURATION AND THE CORRESPONDING INCREASE IN FUEL FLOW (APPROXIMATELY 18 POUNDS PER HOUR) TO THE CLEAN CONFIGURATION FUEL FLOW.

DATA BASIS: DERIVED FROM FLIGHT TEST



K747 Figure 7.1-7. Cruise Chart (Sheet 1 of 23)

CRUISE

PRESSURE ALTITUDE — 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = -30°C

EXAMPLE

WANTED

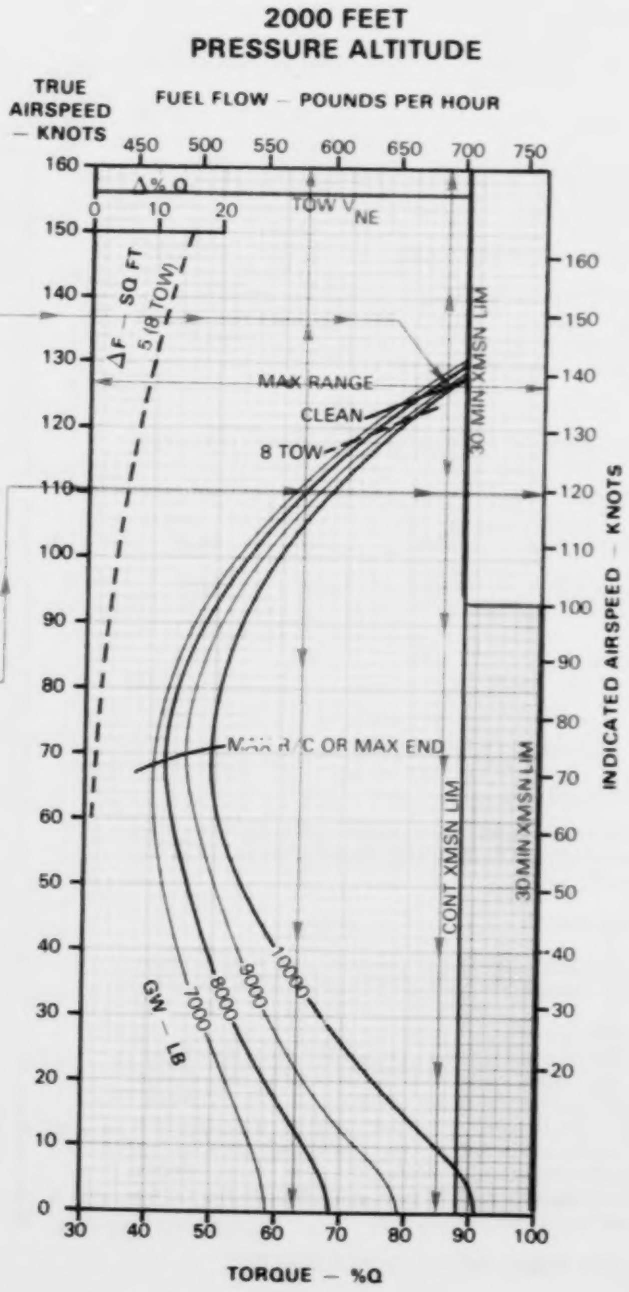
SPEED FOR MAXIMUM RANGE
TORQUE REQUIRED AND FUEL FLOW AT MAXIMUM RANGE SPEED FOR MAXIMUM ENDURANCE

KNOWN

CLEAN CONFIGURATION, FAT = -30°C, PRESSURE ALTITUDE = 2000 FEET, AND GROSS WEIGHT = 9000 POUNDS

METHOD

LOCATE (-30°C FAT, 2000 FEET) CHART
FIND INTERSECTION OF 9000 LB GROSS WEIGHT LINE WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
  MOVE LEFT, READ TAS = 128.5 KNOTS AND
  MOVE RIGHT, READ IAS = 140 KNOTS
TO READ FUEL FLOW REQUIRED:
  MOVE UP, READ DUEL FLOW = 700 LB/HR
TO READ TORQUE REQUIRED
  MOVE DOWN, READ TORQUE = 87.5% Q
FIND INTERSECTION OF 9000 LB GROSS WEIGHT LINE WITH THE MAXIMUM ENDURANCE LINE
TO READ SPEED FOR MAXIMUM ENDURANCE:
  MOVE LEFT, READ TAS = 70 KNOTS AND
  MOVE RIGHT, READ IAS = 74 KNOTS



SEE FIGURE 7.1-7 (SHT 1) ①

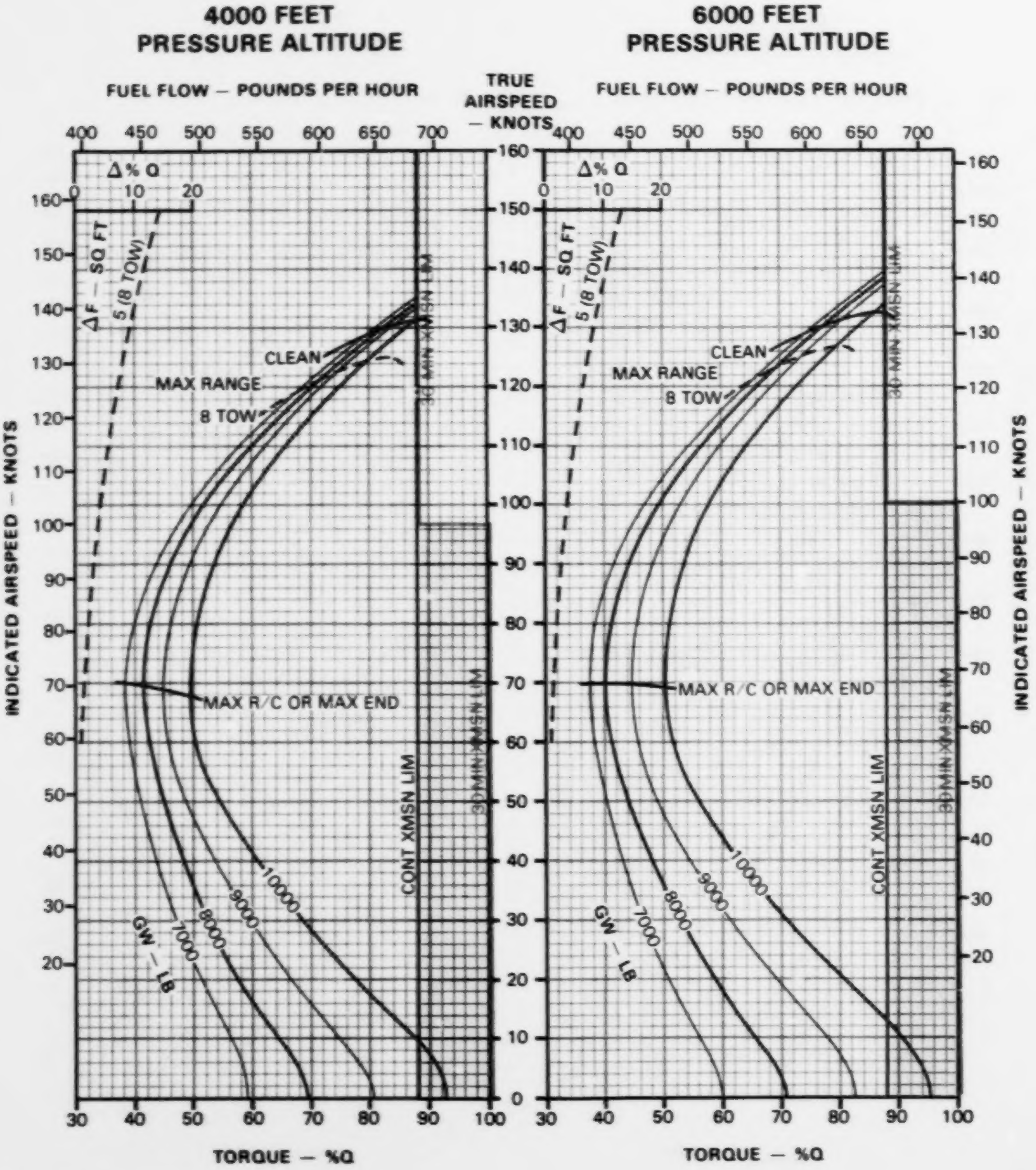
DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 2 of 23)

CRUISE
PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 3 of 23)

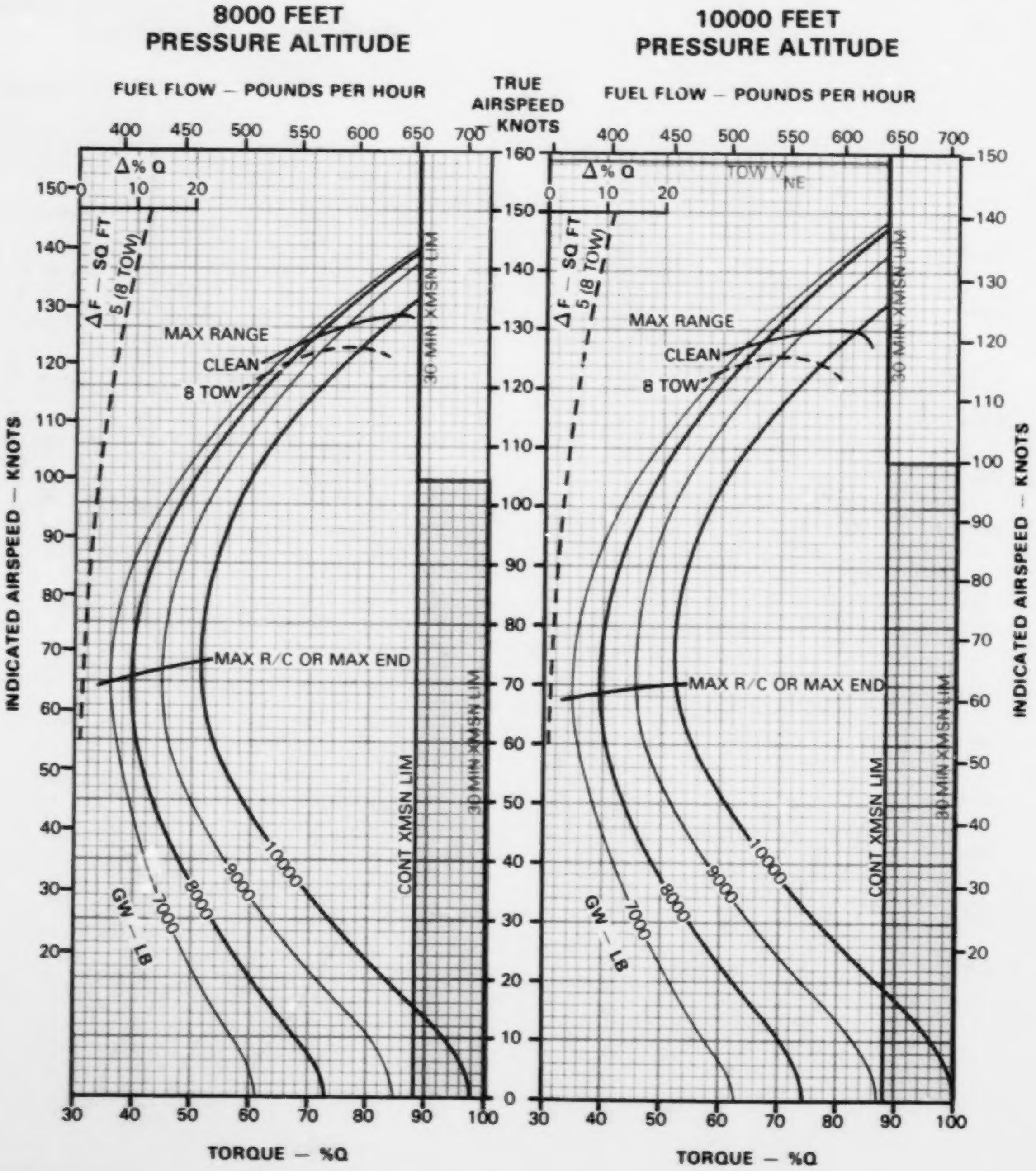
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 **Figure 7.1-7. Cruise Chart (Sheet 4 of 23)**

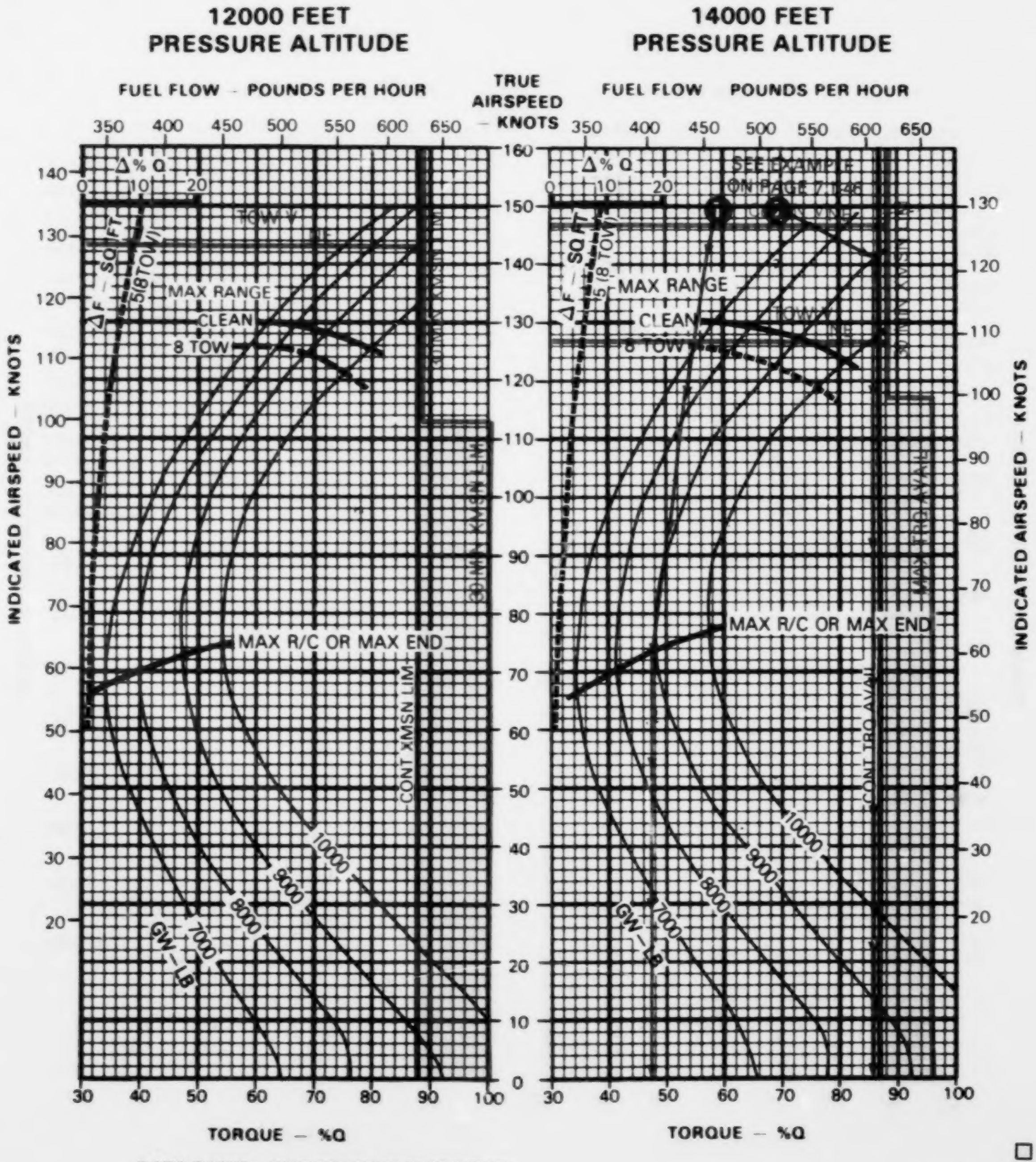
CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 5 of 23)

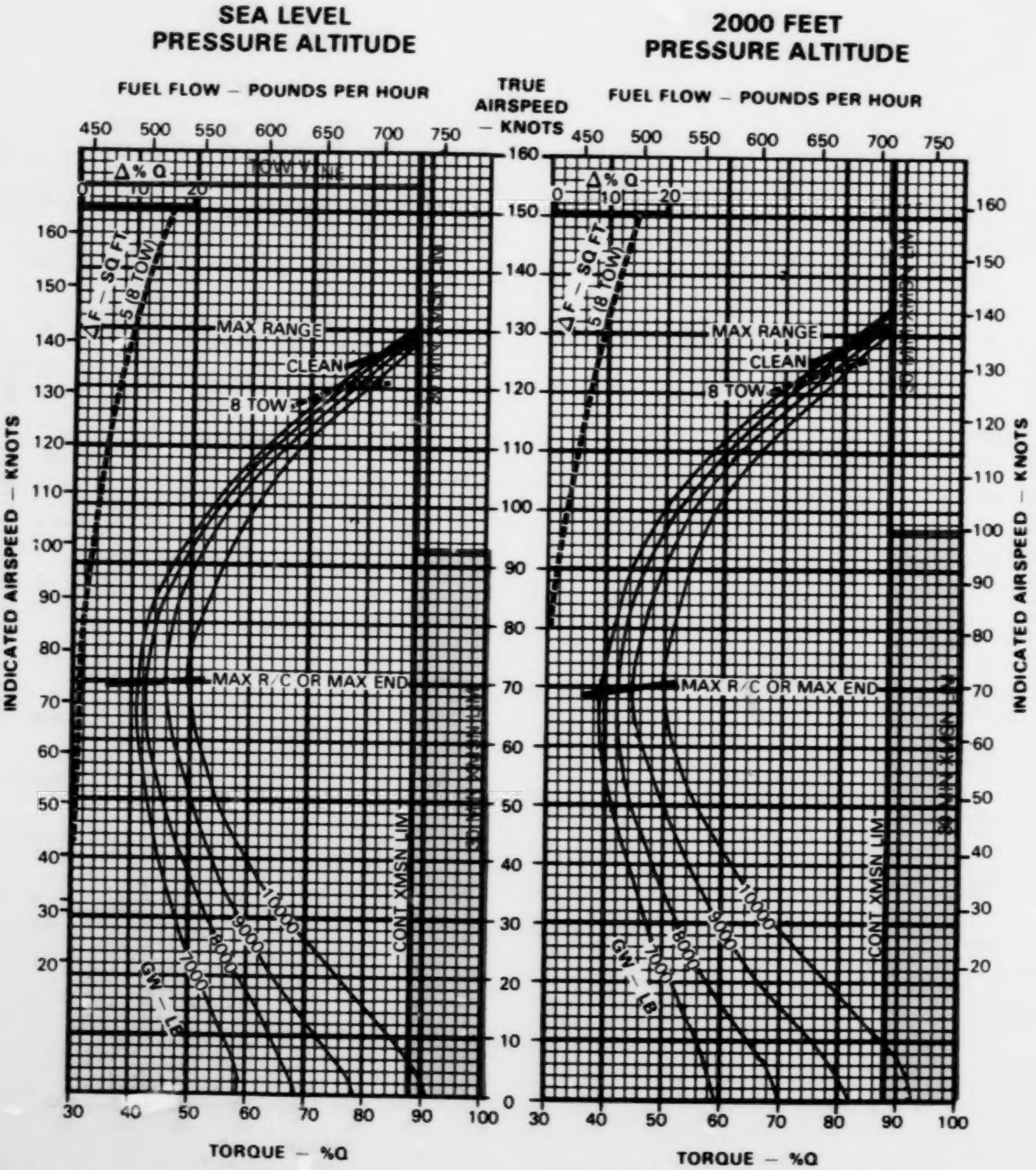
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 **Figure 7.1-7. Cruise Chart (Sheet 6 of 23)**

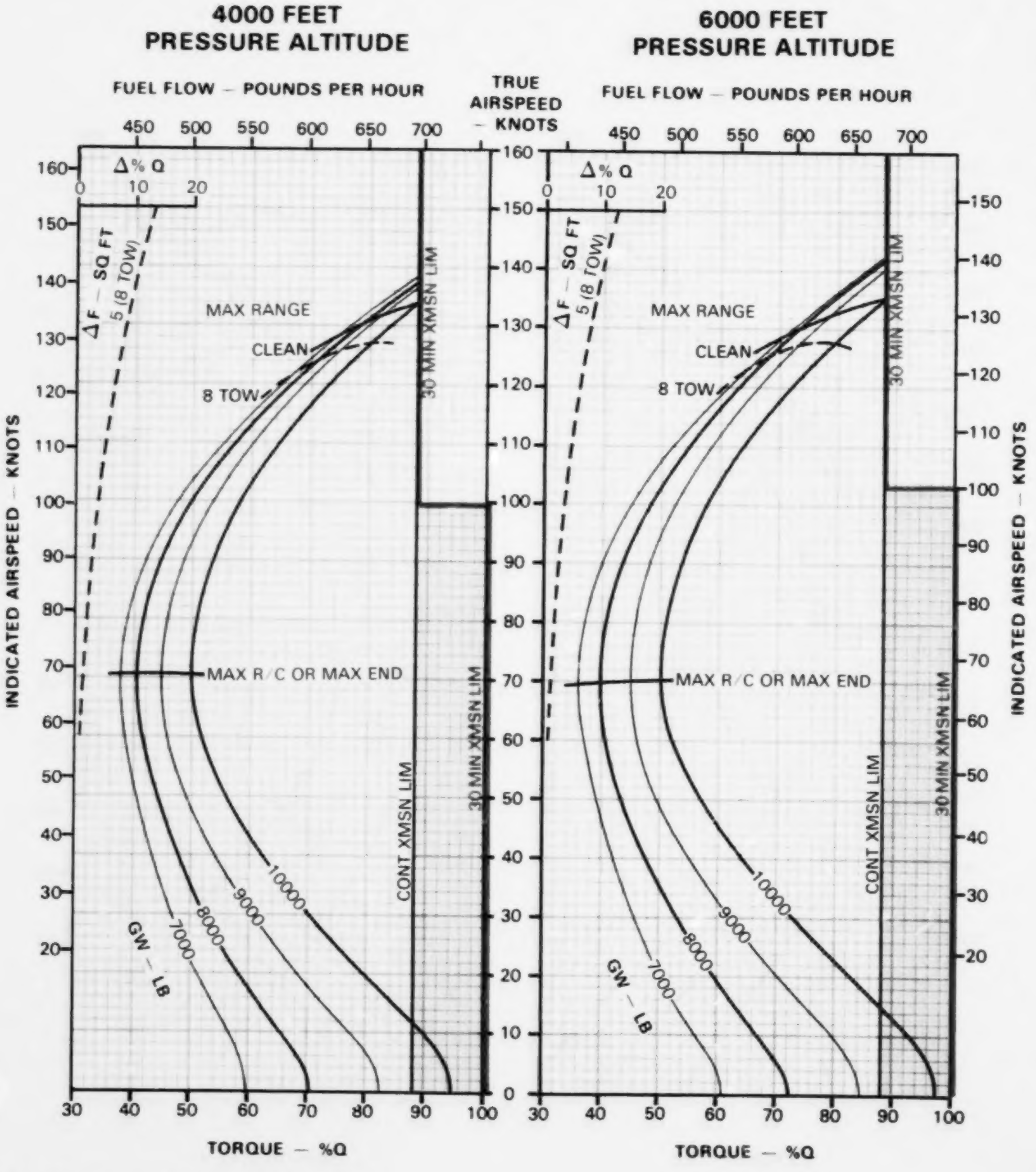
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -15°C


4000 FEET PRESSURE ALTITUDE

6000 FEET PRESSURE ALTITUDE

DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 7 of 23)

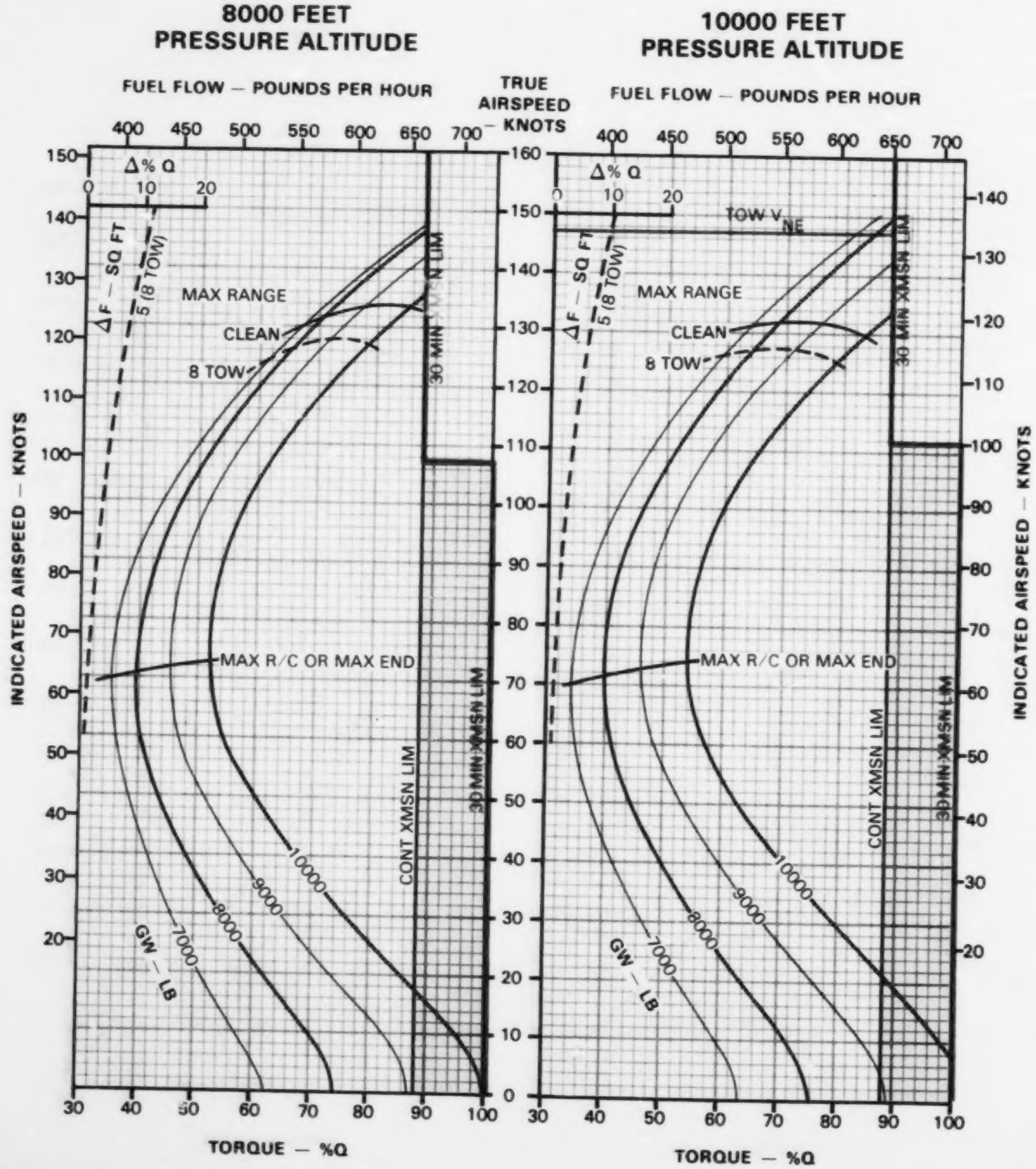
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 8 of 23)

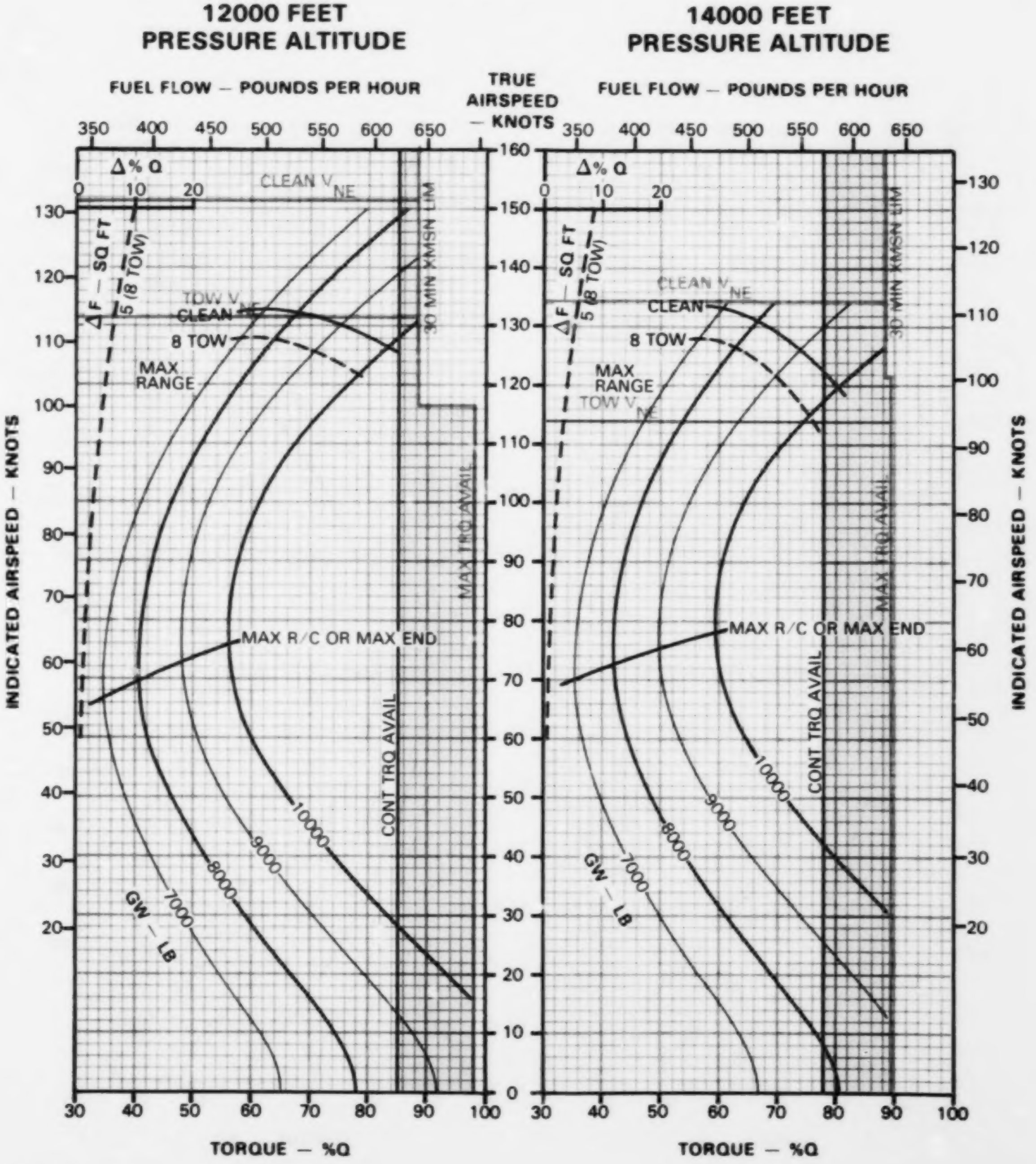
CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = -15°C


12000 FEET PRESSURE ALTITUDE

14000 FEET PRESSURE ALTITUDE

DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 9 of 23)

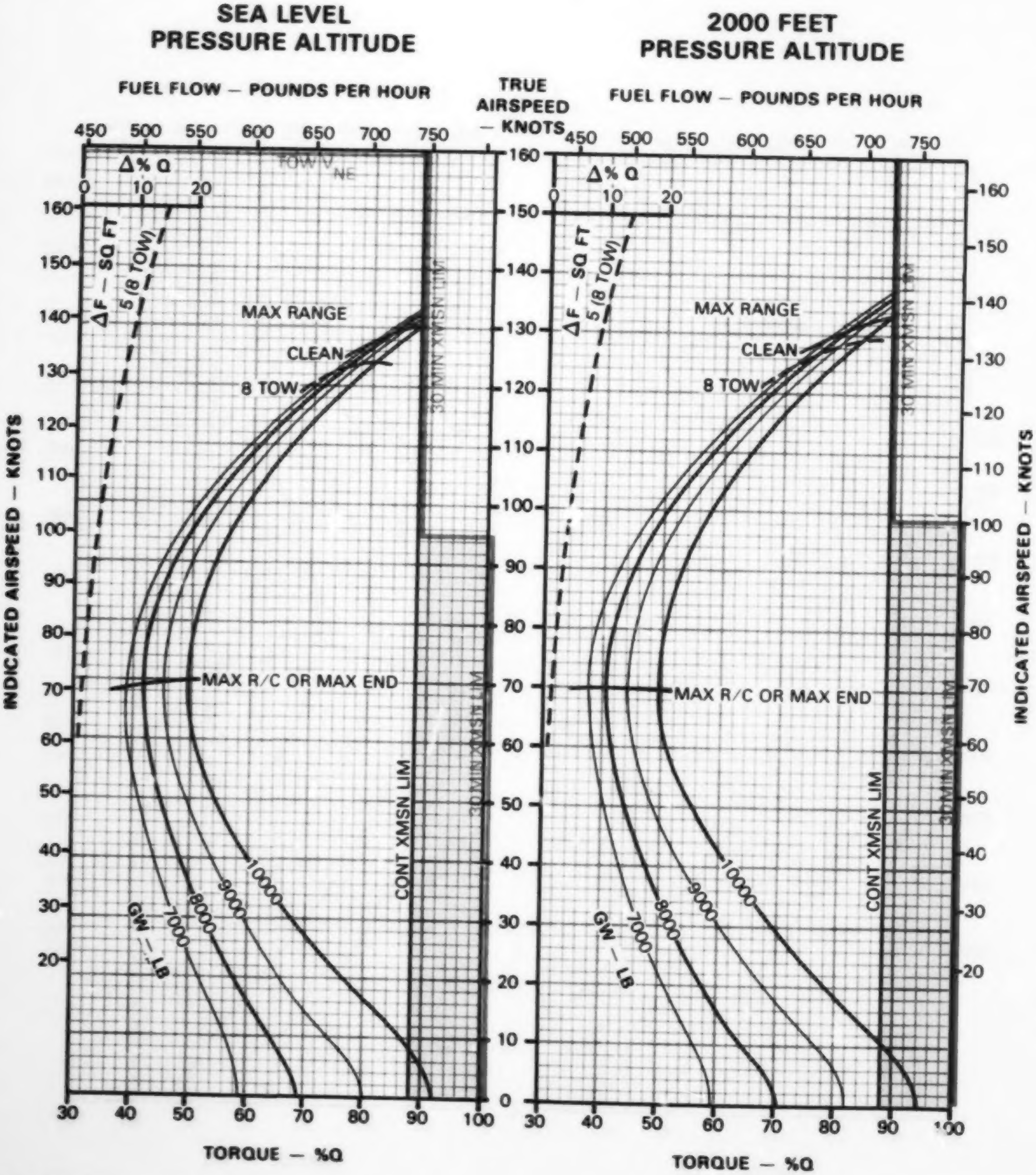
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST

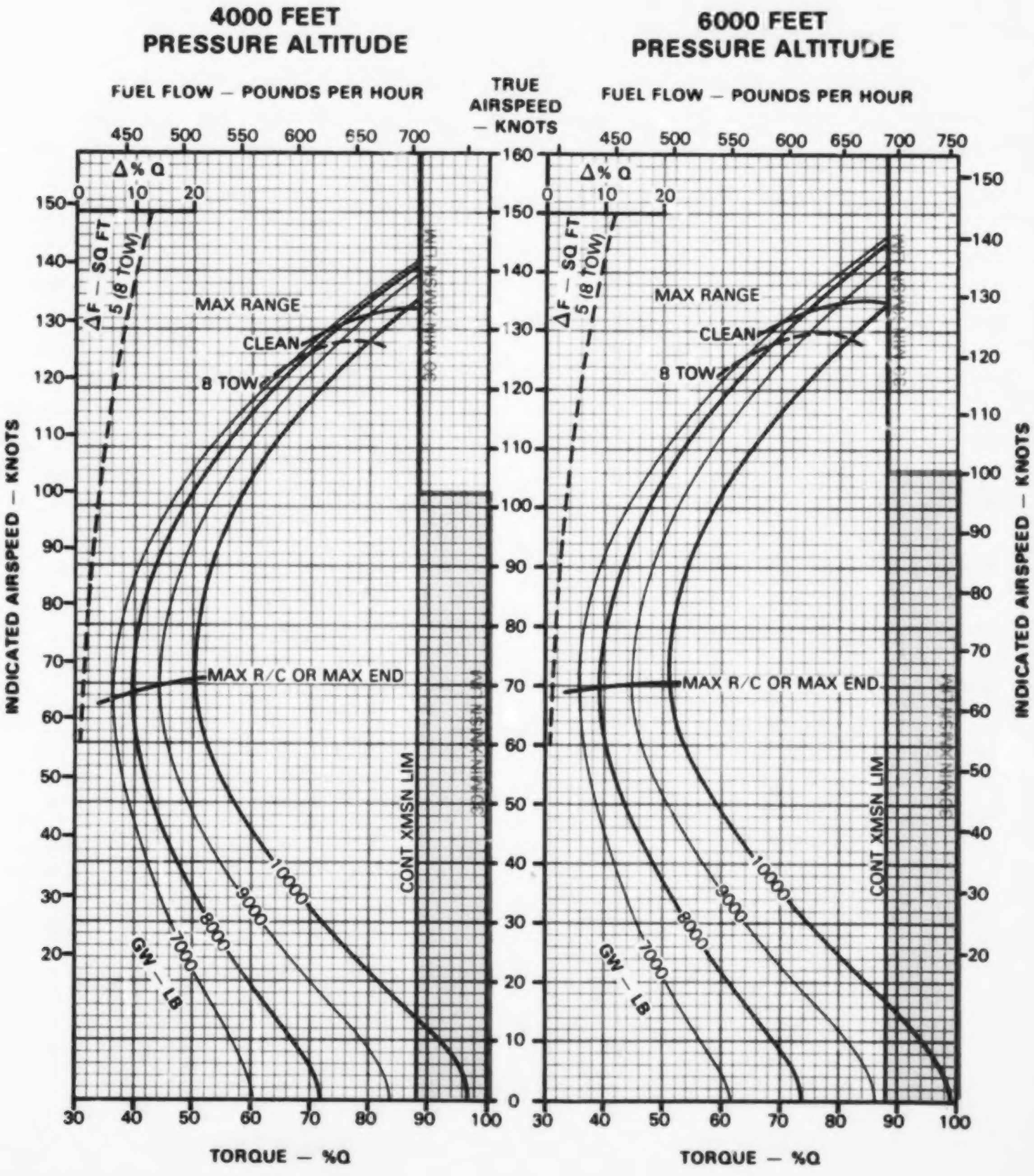
K747 **Figure 7.1-7. Cruise Chart (Sheet 10 of 23)**

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST

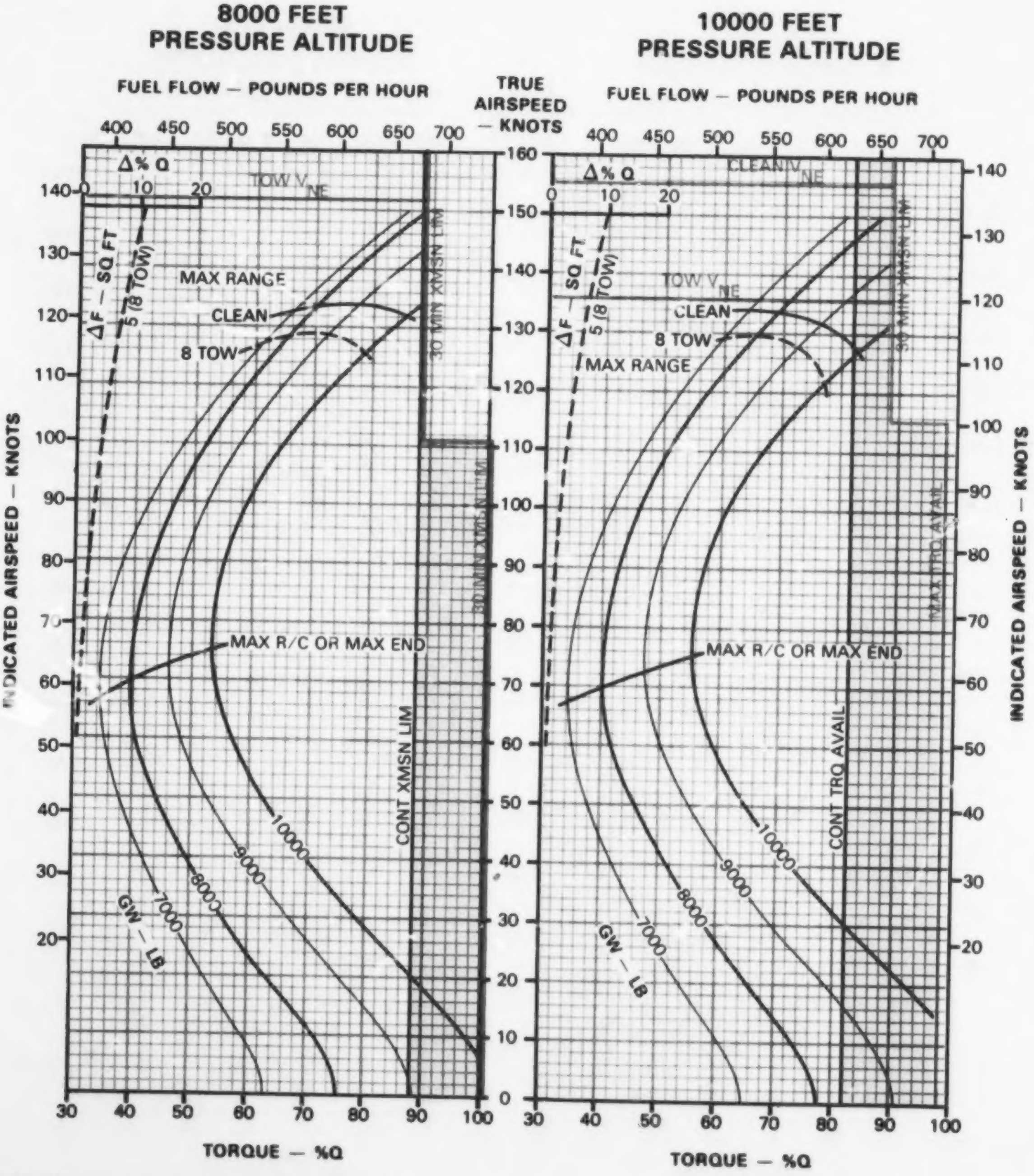
K747 Figure 7.1-7. Cruise Chart (Sheet 11 of 23)

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 12 of 23)

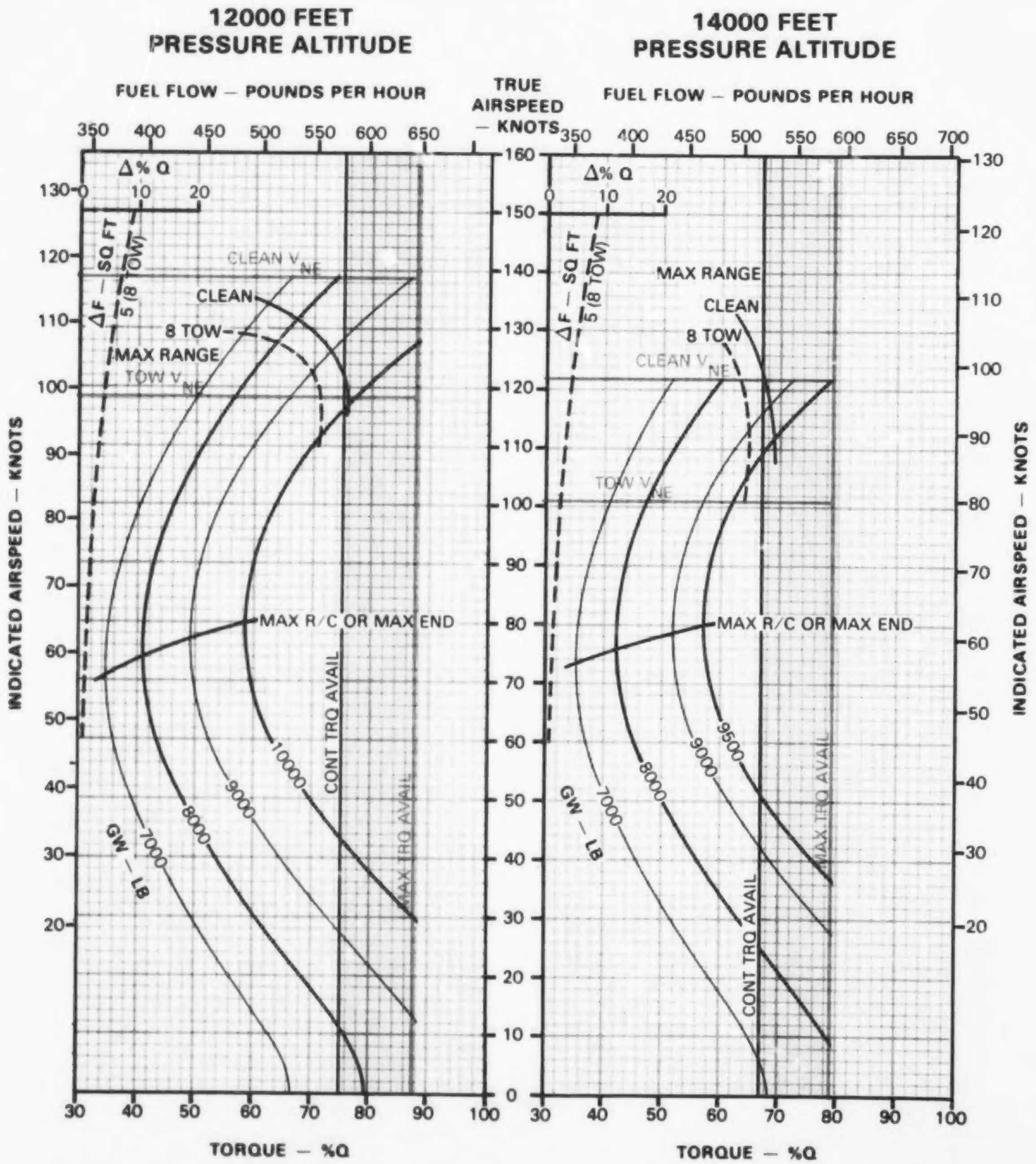
CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = 0°C



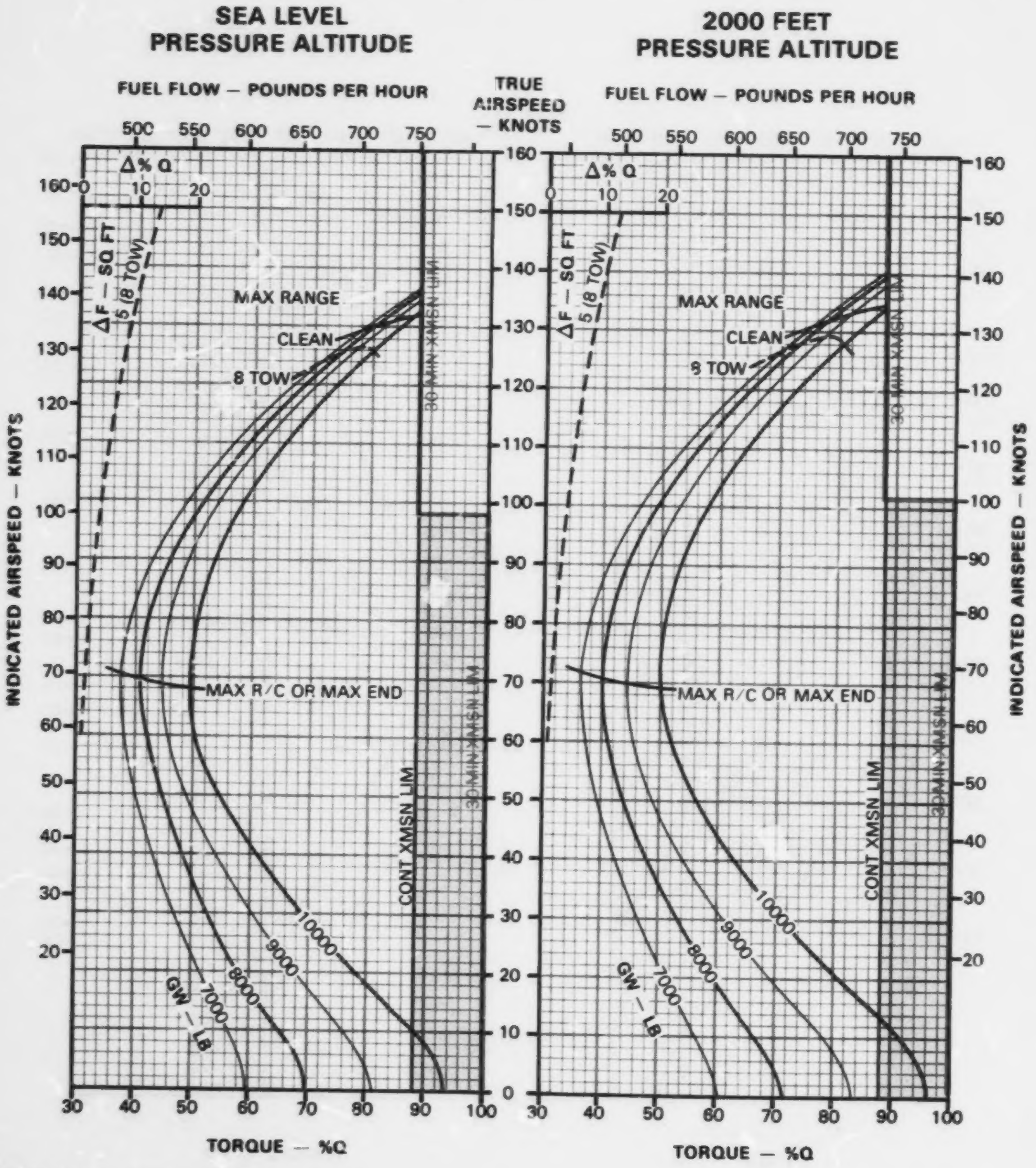
DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 13 of 23)

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +15°C



SEA LEVEL PRESSURE ALTITUDE

2000 FEET PRESSURE ALTITUDE

DATA BASIS: DERIVED FROM FLIGHT TEST

K747 **Figure 7.1-7. Cruise Chart (Sheet 14 of 23)**

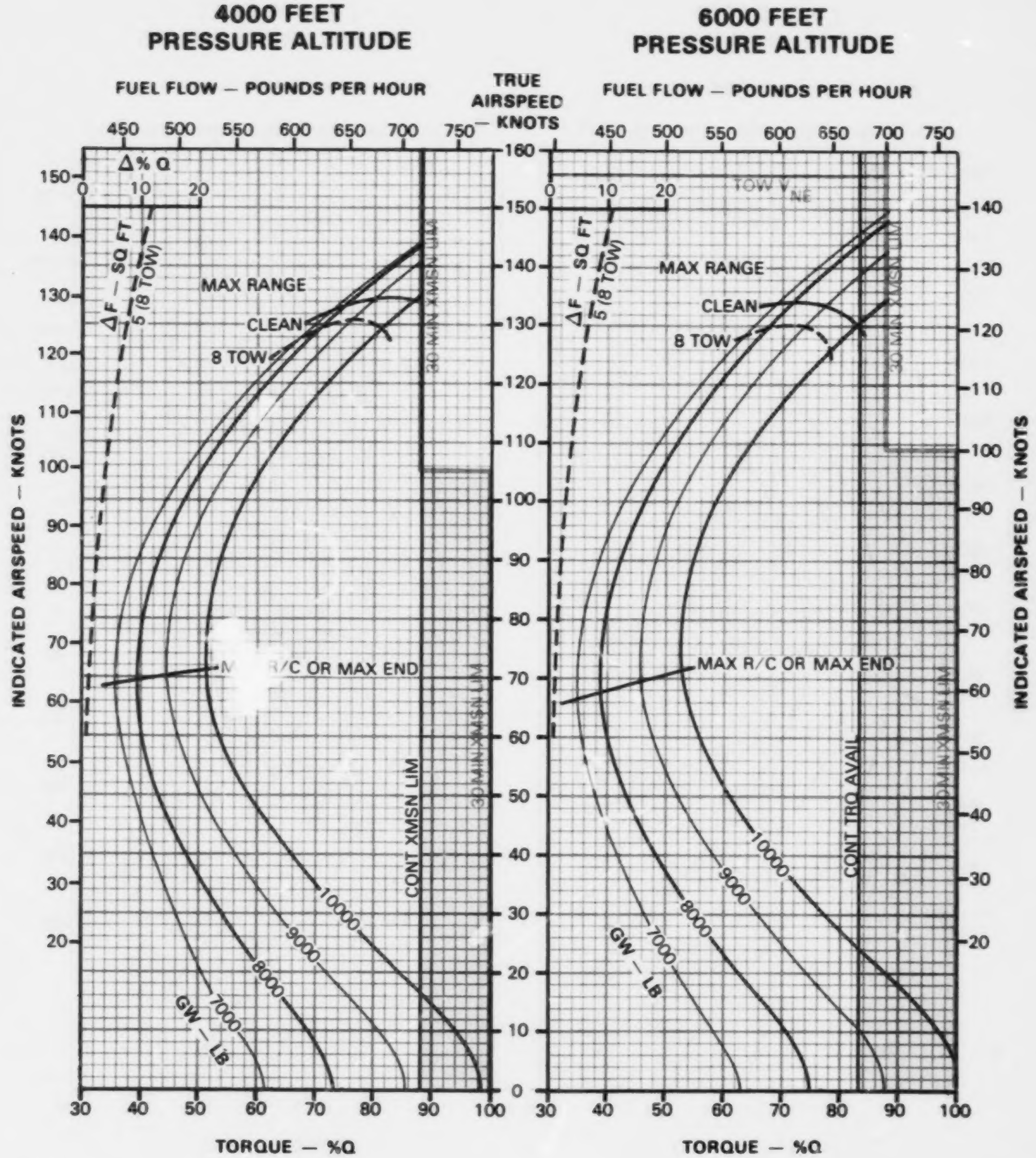
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

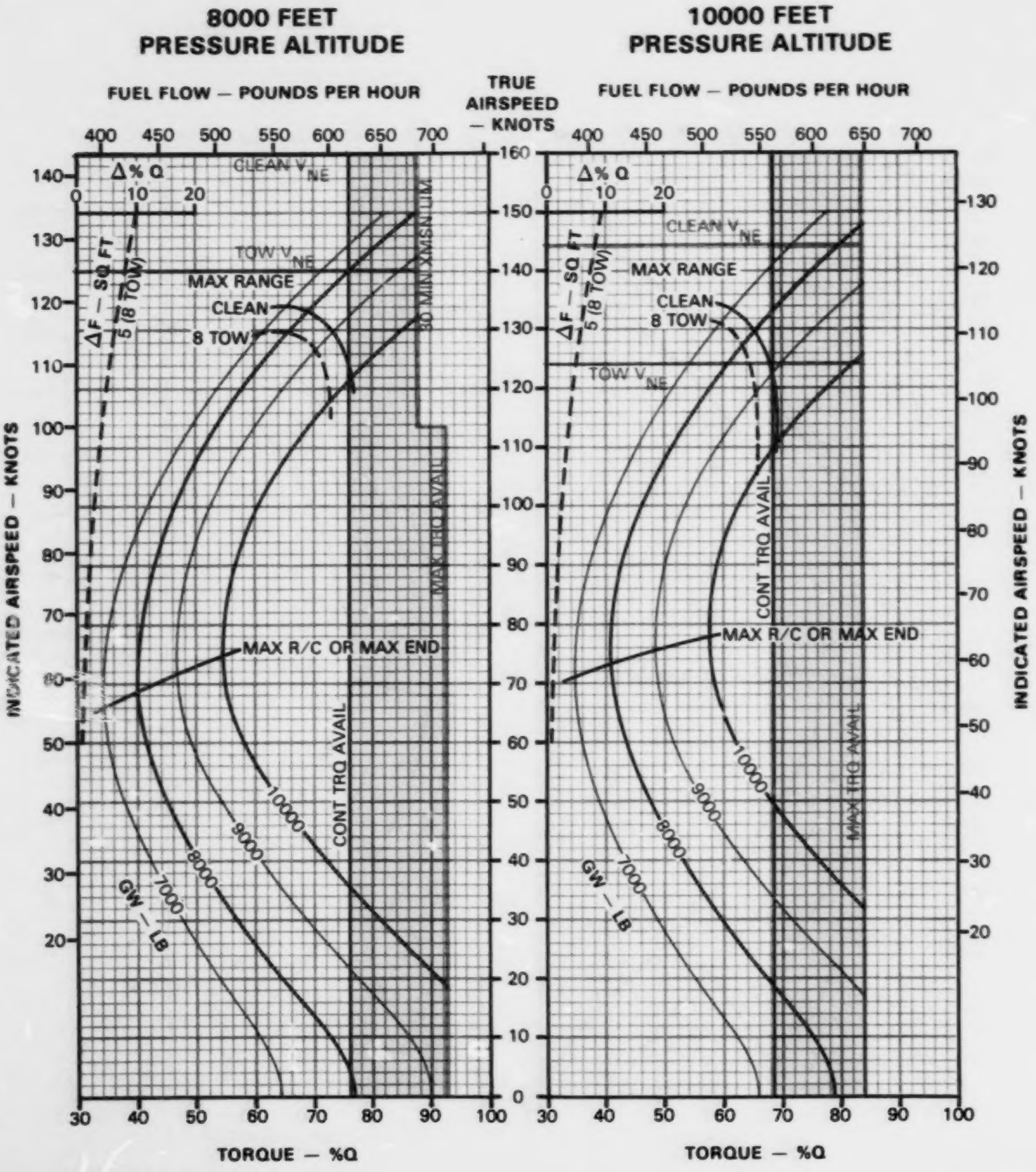
K747 Figure 7.1-7. Cruise Chart (Sheet 15 of 23)

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

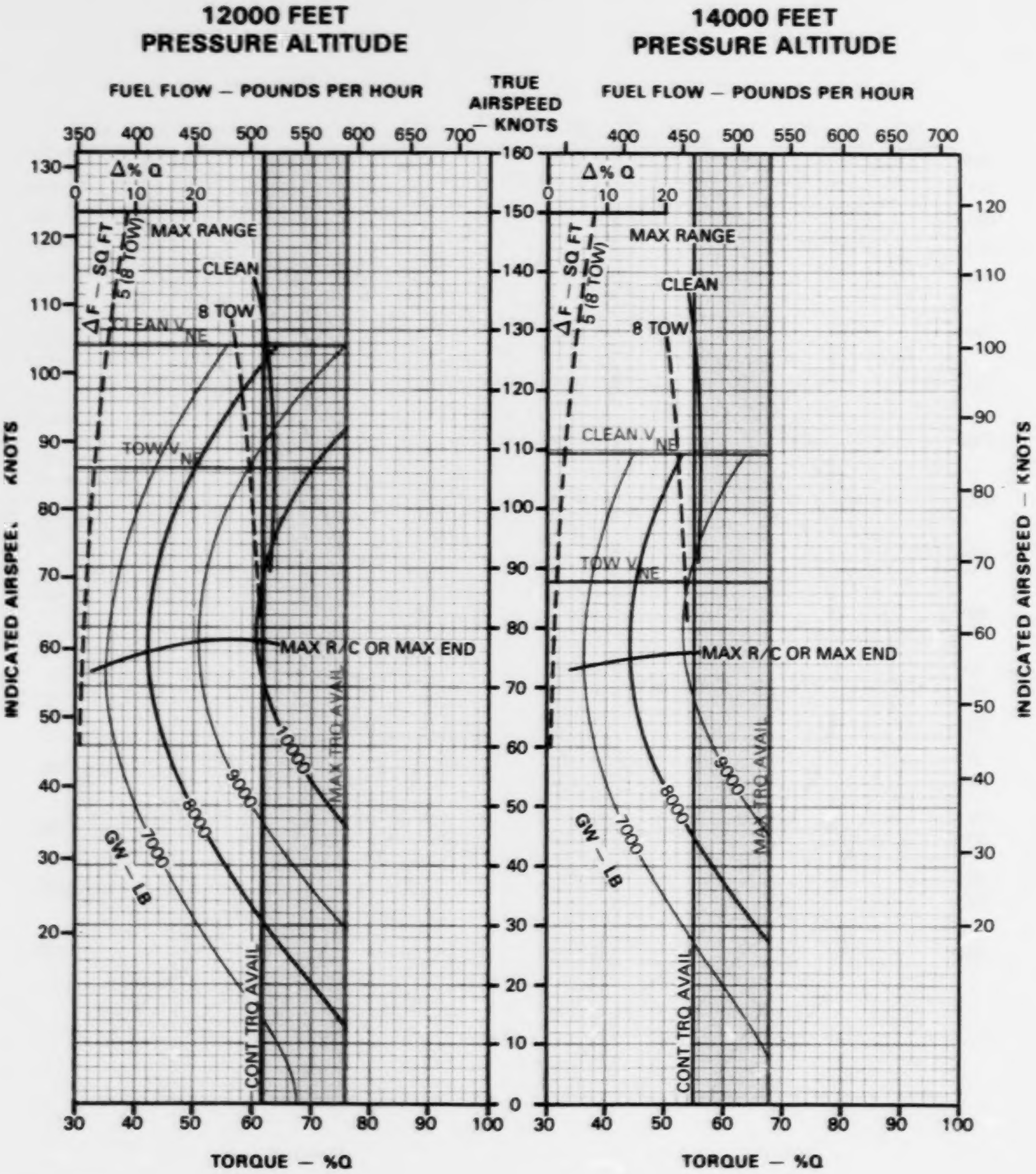
K747 Figure 7.1-7. Cruise Chart (Sheet 16 of 23)

CRUISE

PRESSURE ALTITUDE — 12000 FEET TO 14000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 17 of 23)

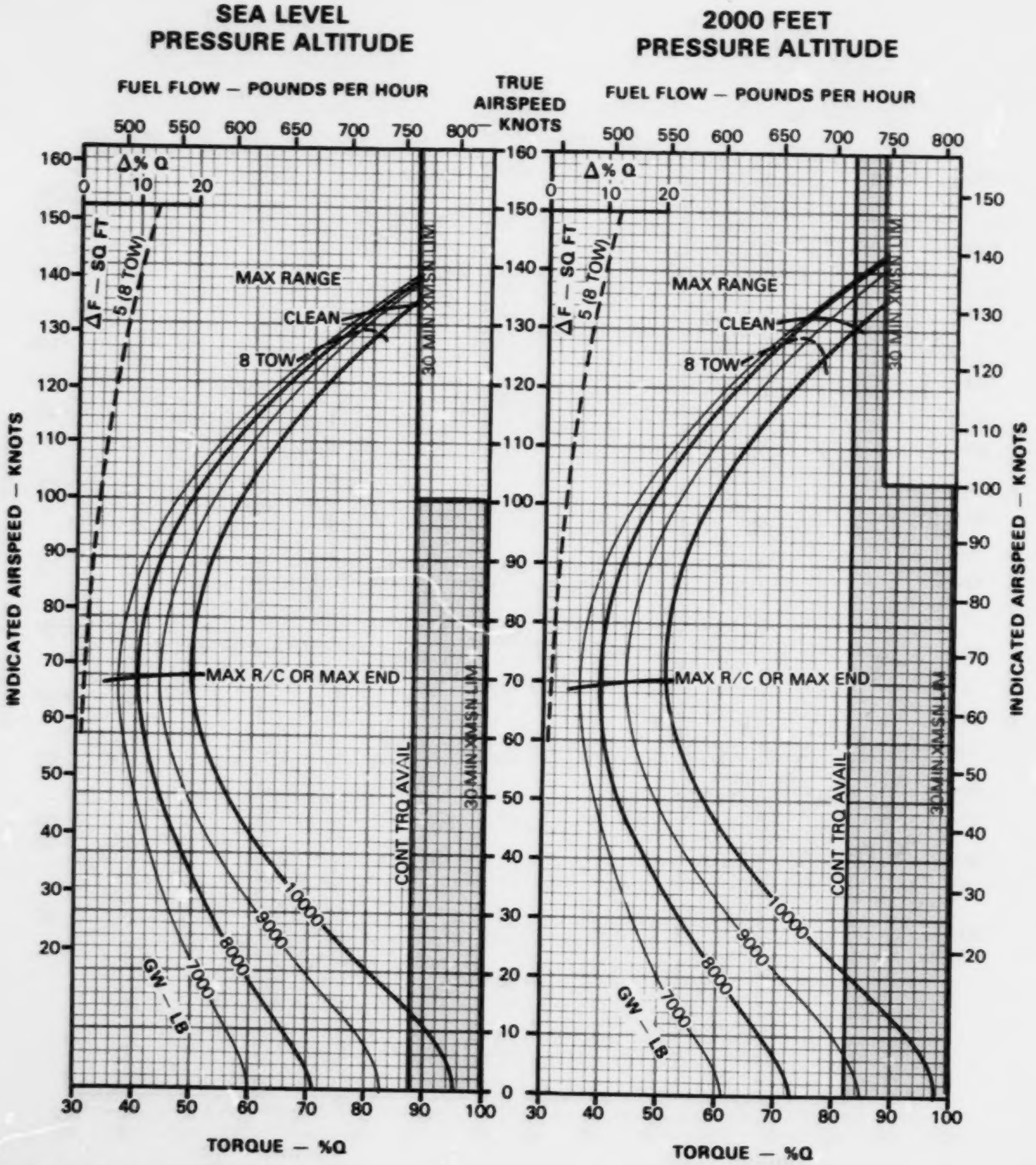
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 18 of 23)

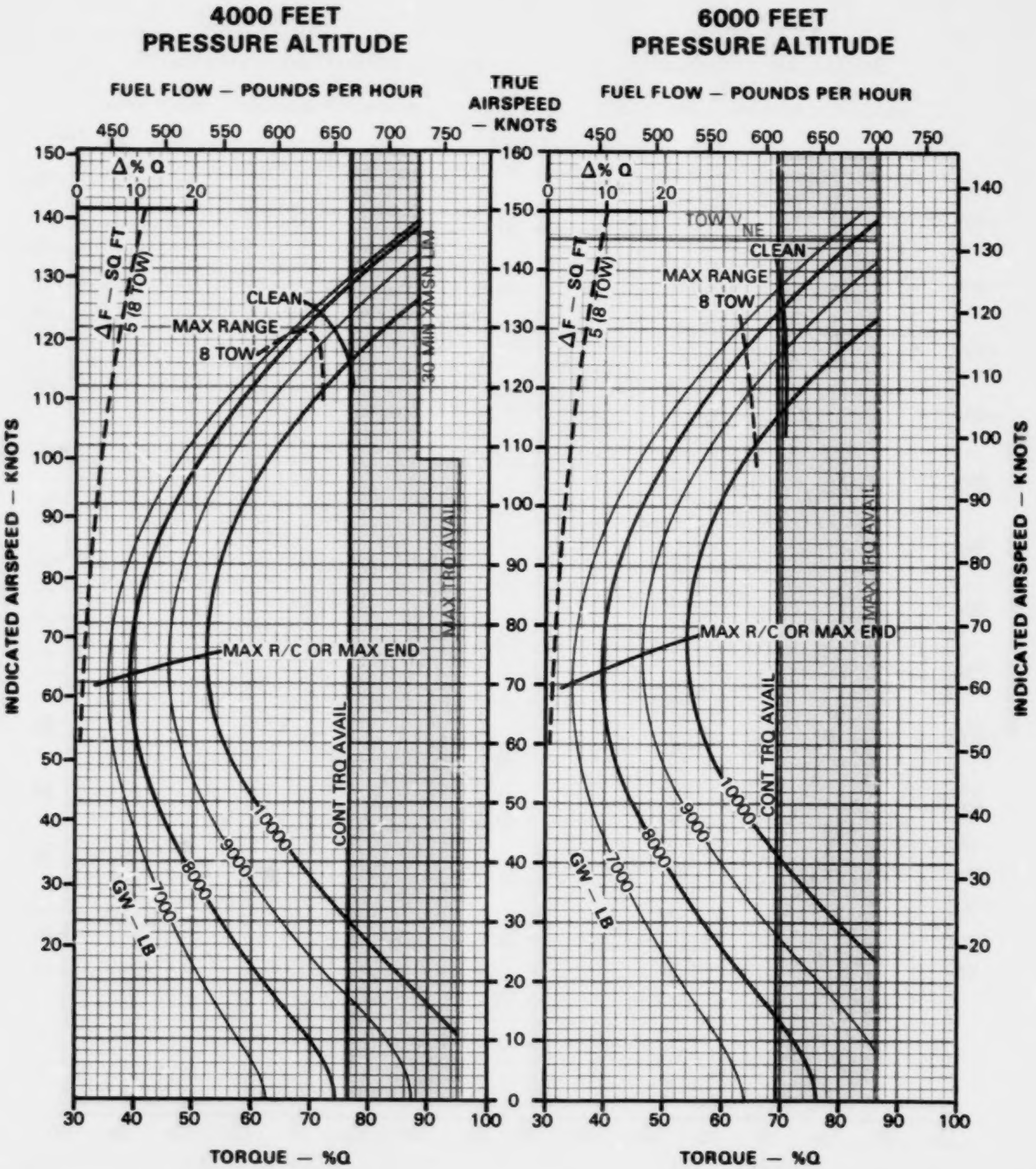
CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +30°C



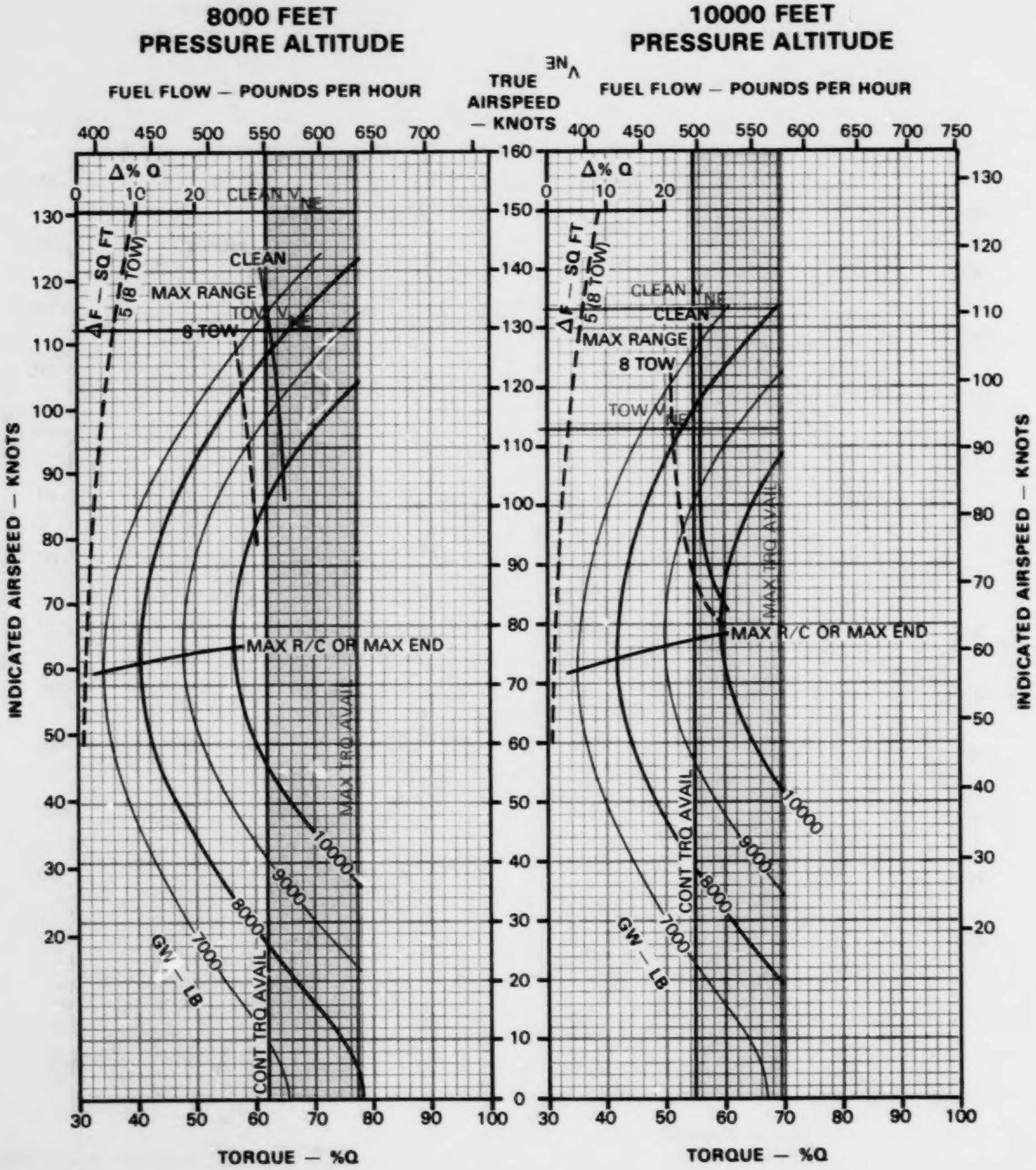
DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 19 of 23)

CRUISE
AH-1S
T53-L-703

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST

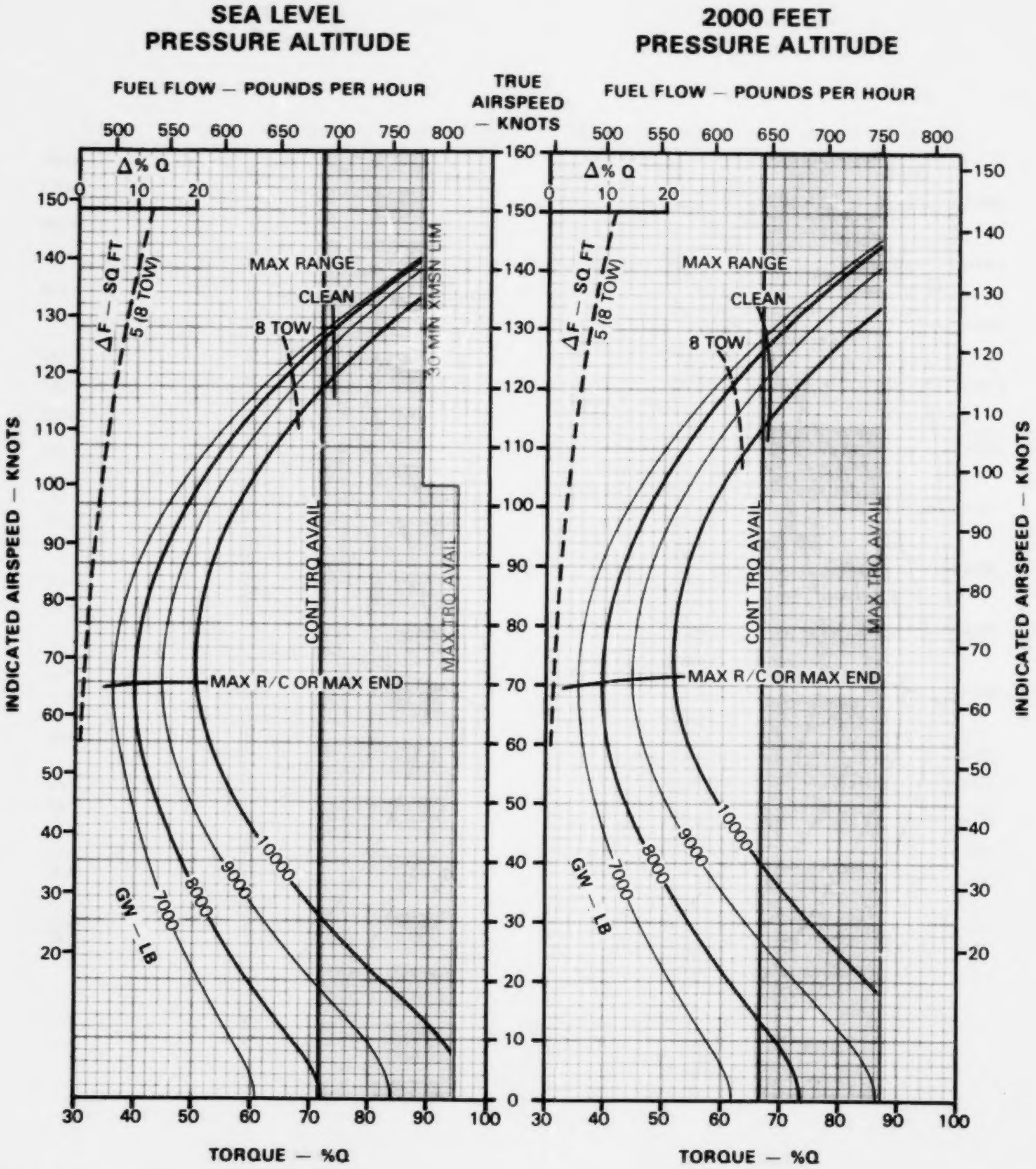
K747 Figure 7.1-7. Cruise Chart (Sheet 20 of 23)

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST

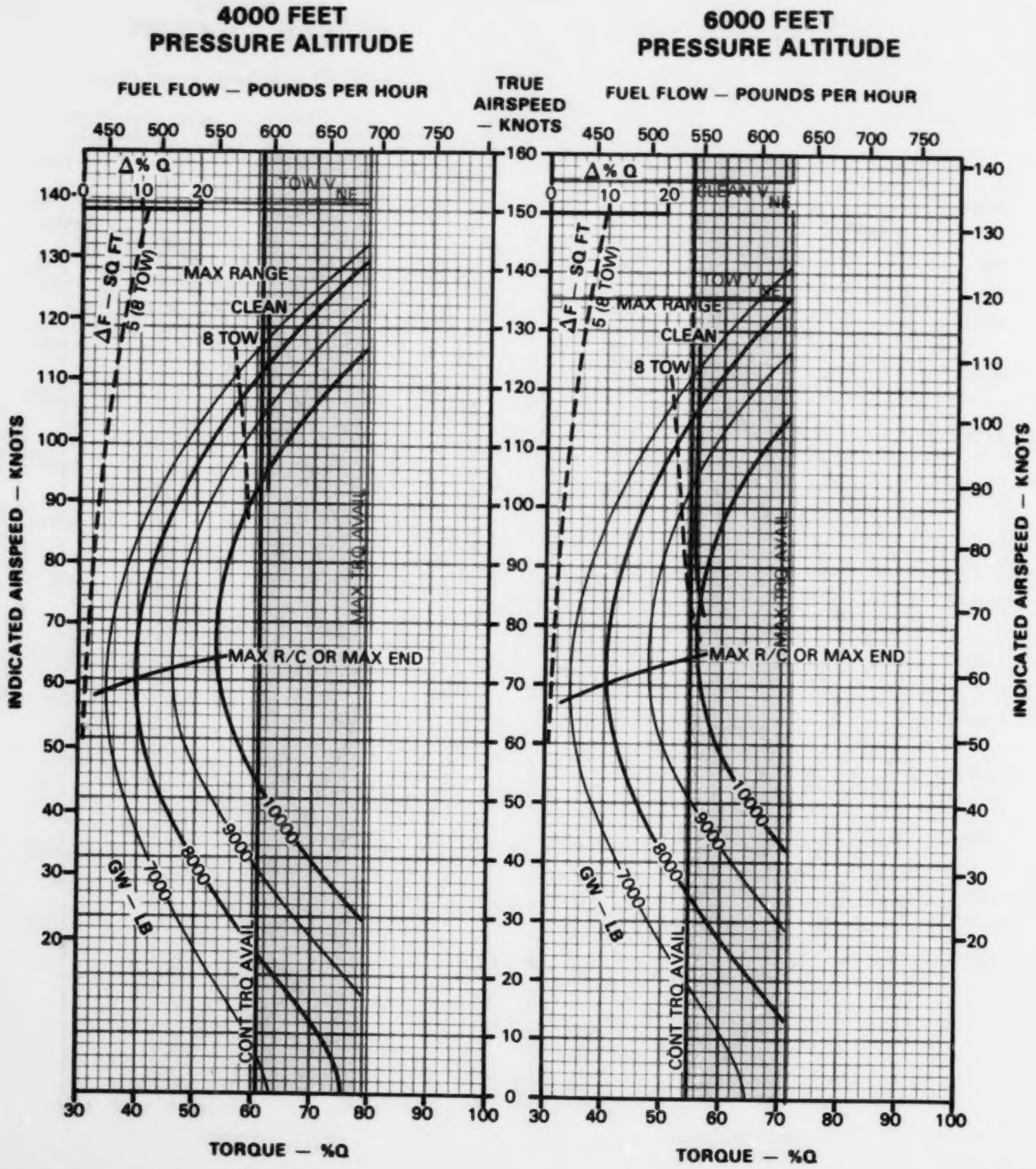
K747 Figure 7.1-7. Cruise Chart (Sheet 21 of 23)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET

100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

FAT = +45°C



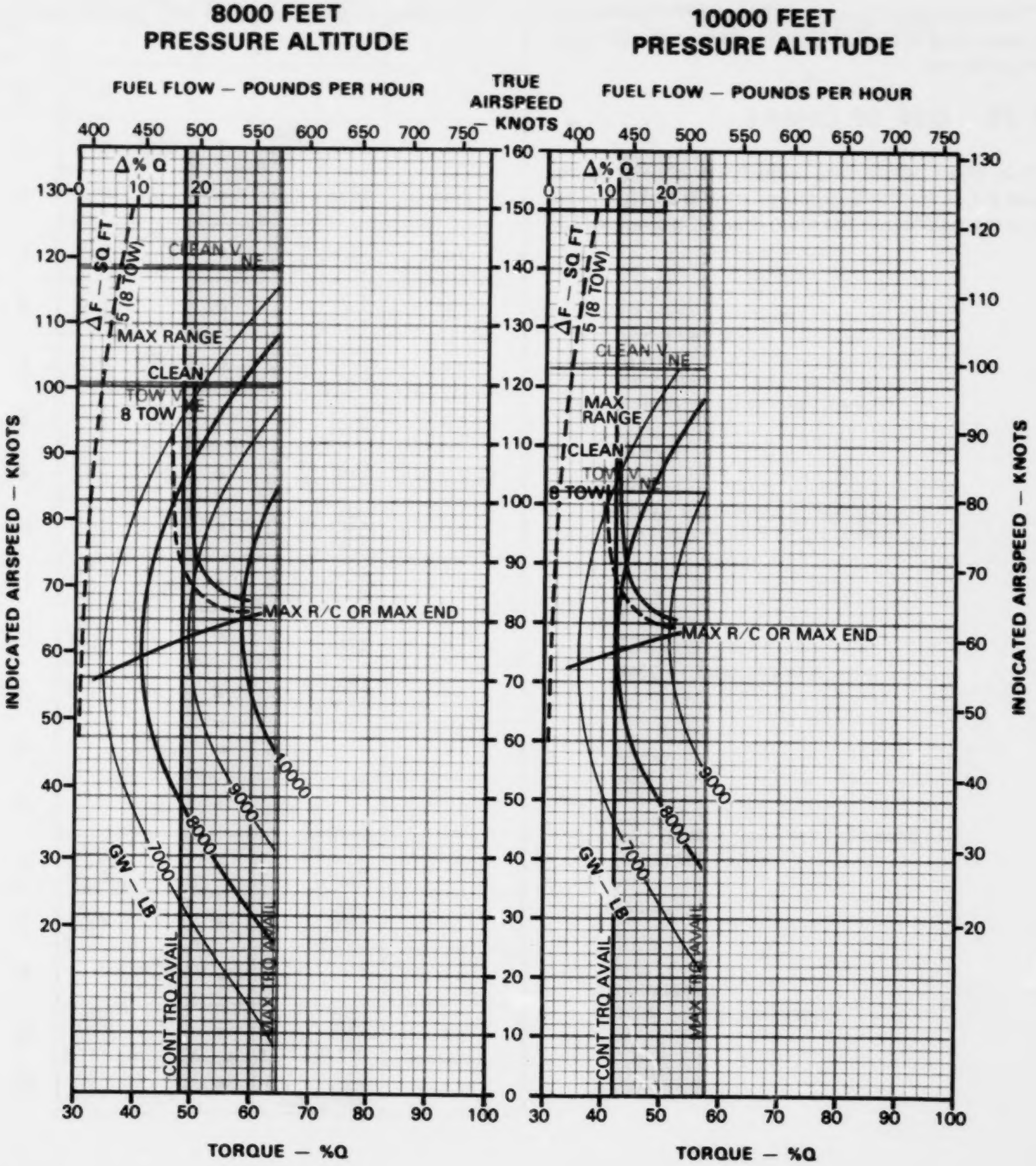
DATA BASIS: DERIVED FROM FLIGHT TEST

K747 **Figure 7.1-7. Cruise Chart (Sheet 22 of 23)**

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 10000 FEET
100% RPM, CLEAN CONFIGURATION, JP-4 FUEL

CRUISE
AH-1S
T53-L-703

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-7. Cruise Chart (Sheet 23 of 23)

SECTION VII. DRAG

7.1-27. DESCRIPTION.

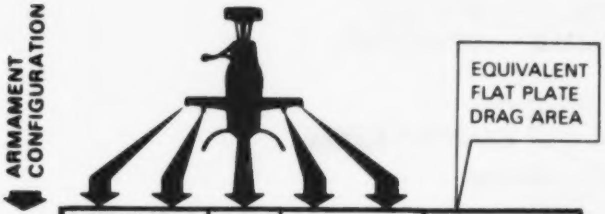
The drag chart (figure 7.1-8) shows the equivalent flat plate drag area (△F) increment of all approved configurations.

7.1-28. USE OF CHART.

This chart is used to adjust the cruise charts (figure 7.1-7) for the appropriate torque and fuel flow due to the equivalent flat plate drag area change (△ F).

7.1-29. CONDITIONS.

The drag chart is based on 100 percent rpm.



ARMAMENT CONFIGURATION	WING STORES	WING STORES	TURRET	WING STORES	WING STORES	ΔF - SQ FT
1			A			0
2	F		A		F	2.8
3	F	B	A	B	F	6.3
4	F	E	A	E	F	4.0
5	F	C	A	C	F	4.5
6	D		A		D	5.0
7	D	B	A	B	D	8.8
8	D	E	A	E	D	6.5
9	D	C	A	C	D	7.0
10	C	C	A	C	C	3.2
11	C	B	A	B	C	5.2
12	B	E	A	E	B	5.0
13	C	E	A	E	C	2.5
14		B	A	B		3.1
15		E	A	E		1.0
16	C		A		C	1.4
17	B		A		B	3.2
18		C	A	C		1.3
19	B	B	A	B	B	7.7
20	B	C	A	C	B	5.3

A A

UNIVERSAL TURRET
(M-197 20MM AUTOMATIC GUN)

B B

ROCKET LAUNCHER – M200A1
19 TUBE M261

CAUTION

The 19 tube rocket launcher is restricted to a maximum of twelve (12) seventeen (17) pound warhead rockets when mounted on outboard pylons. Refer to Chapter 6 for restrictions on other combinations.

C C

ROCKET LAUNCHER – M158
7 TUBE M260

D D

TOW MISSILE –
M65 – TWO LAUNCHERS

E E

WING GUN POD – M18 OR M18A1
(7.62MM GUN)

F F

TOW MISSILE
M65 – ONE LAUNCHER

Figure 7.1-8. Drag chart

SECTION VIII. CLIMB — DESCENT

7.1-30. DESCRIPTION — CLIMB-DESCENT CHART.

The upper grid of the climb descent chart (figure 7.1-9) shows the change in torque (above or below torque required for level flight under the same gross weight and atmospheric conditions) to obtain a given rate of climb or descent.

7.1-31. USE OF CLIMB-DESCENT CHART.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the upper grid scale must be added to the torque required for level flight (for climb) - or subtracted from the torque required for level flight (for descent) - obtained from the appropriate cruise chart in order to obtain a total climb or descent torque.

b. By entering the bottom of the upper grid with a known torque change, moving upward to the gross weight, and left to the corresponding rate of climb or descent.

NOTE

Torque available data shown in figures 7.1-3, 7.1-4, and 7.1-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7.1-1.

7.1-32. CONDITIONS.

The climb-descent chart is based on the use of 100 percent rpm.

EXAMPLE K747

WANTED

EXCESS TORQUE AVAILABLE FOR CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

CLEAN CONFIGURATION

GROSS WEIGHT = 9000 LB

FAT = -30°C

PRESSURE ALTITUDE = 14000 FEET

METHOD

LOCATE CHART (FIGURE 7.1-7, (Sheet 5)

FIND INTERSECTION OF 9000 LB GROSS WEIGHT

LINE WITH THE MAXIMUM RATE OF CLIMB LINE——①

MOVE DOWN, READ TORQUE REQUIRED = 48.3% Q

FIND INTERSECTION OF 9000 LB GROSS WEIGHT

LINE WITH THE CONTINUOUS TORQUE AVAILABLE LINE—②

MOVE DOWN, READ TORQUE AVAILABLE = 87% Q

EXCESS TORQUE AVAILABLE = (87 - 48.3) = 38.7% Q

WANTED

RATE OF CLIMB AT 60 KIAS

MAXIMUM CONTINUOUS POWER

KNOWN

EXCESS TORQUE AVAILABLE (FROM EXAMPLE ON FIGURE 7.1-7, (Sheet 5) = 38.7% Q

GROSS WEIGHT = 9000 LB

METHOD

ENTER CALIBRATED TORQUE SCALE HERE——③

MOVE UP TO GROSS WEIGHT LINE

MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE, READ RATE OF CLIMB = 1440 FT/MIN

CLIMB — DESCENT

CLIMB — DESCENT
AH-1S
T53-L-703

EXAMPLE

WANTED

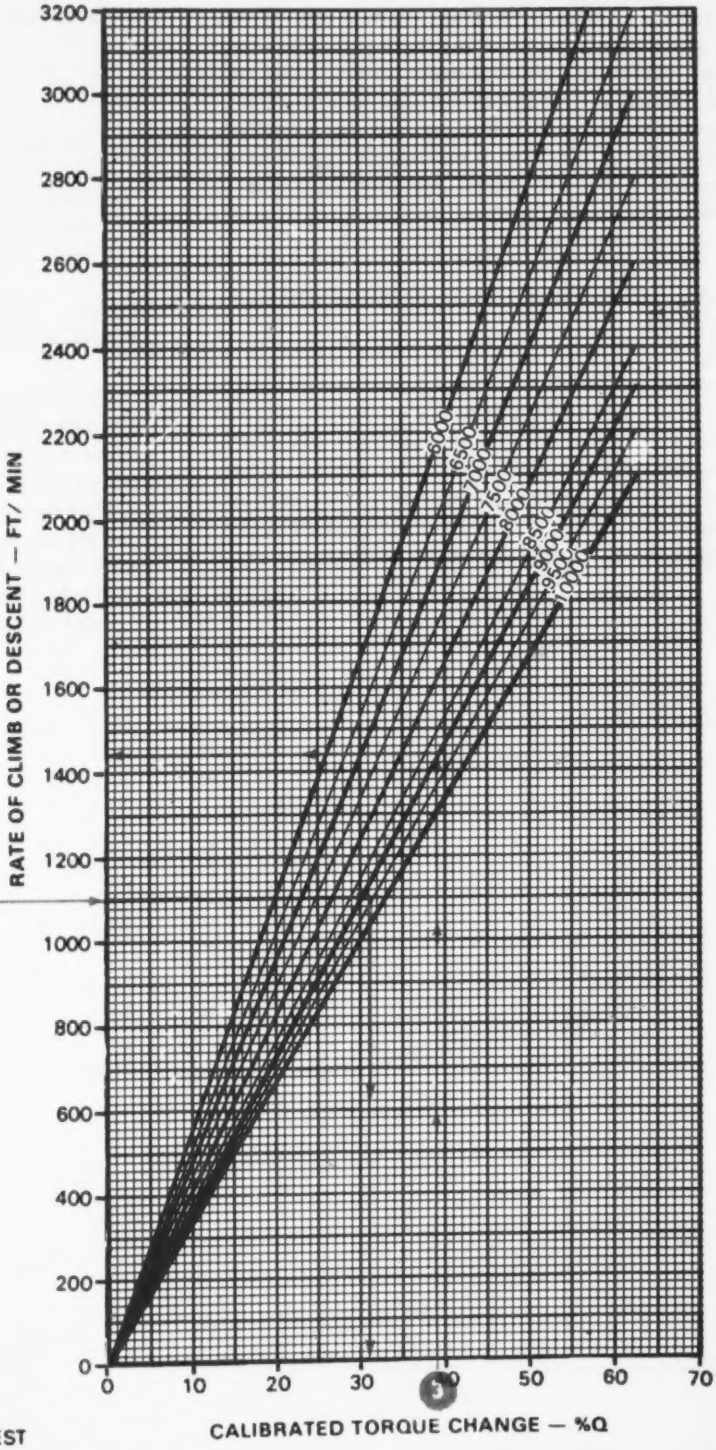
CALIBRATED TORQUE CHANGE
FOR DESIRED R/C OR R/D

KNOWN OR ESTIMATED

GROSS WEIGHT = 9500 LB
DESIRED R/C = 1100 FT/MIN

METHOD

ENTER R/C HERE
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN, READ CALIBRATED
TORQUE CHANGE = 31% Q



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-9. Climb — Descent Chart

7.1-33. DESCRIPTION — CLIMB PERFORMANCE CHART.

The climb performance chart (figure 7.1-10) represents a synthesis of the cruise charts to ease estimation of the climb portion of the flight plan. The chart shows relationships between gross weight, initial and final altitude and temperatures, and time to climb, distance covered while climbing, and fuel expended while climbing. The chart is presented for climbing at maximum torque (30-minute operation) and with 8 TOW configuration. However, this chart may be used for all configurations.

7.1-34. USE OF CLIMB PERFORMANCE CHART.

Enter at the top left at the known gross weight, move right to the initial altitude, move down to the free air temperature at that altitude, and move left and record time, distance, and fuel flow for that altitude. Enter again at the gross weight, move right to the final altitude, move down to the free air temperature at that altitude, and move right and record the time, distance, and fuel flow for that altitude. Subtract the time, distance, and fuel flow values of the initial altitude-temperature condition form those of the final altitude-temperature condition to find the time to climb, distance covered, and fuel used while climbing.

NOTE

Torque available data shown in figures 7.1-3, 7.1-4, and 7.1-7 are in error. To determine correct torque available, reduce the chart values by the amounts shown in table 7.1-1.

7.1-35. CONDITIONS — CLIMB PERFORMANCE CHART.

The chart represents climb at optimum condition, that is minimum power required and maximum (30 minute) power available. Climb is assumed to be at 60 knots IAS as this is near the airspeed for maximum rate of climb at most atmospheric conditions. Warmup and taxi fuel are not included in fuel flow calculations. Climb performance is calculated for 100 percent rpm. The chart is based on a no-wind condition, therefore distance traveled will not be valid when winds are present.

CLIMB PERFORMANCE (MAXIMUM TORQUE -30 MINUTE OPERATION)

100% RPM CLIMB AT 60 KIAS

EXAMPLE

WANTED

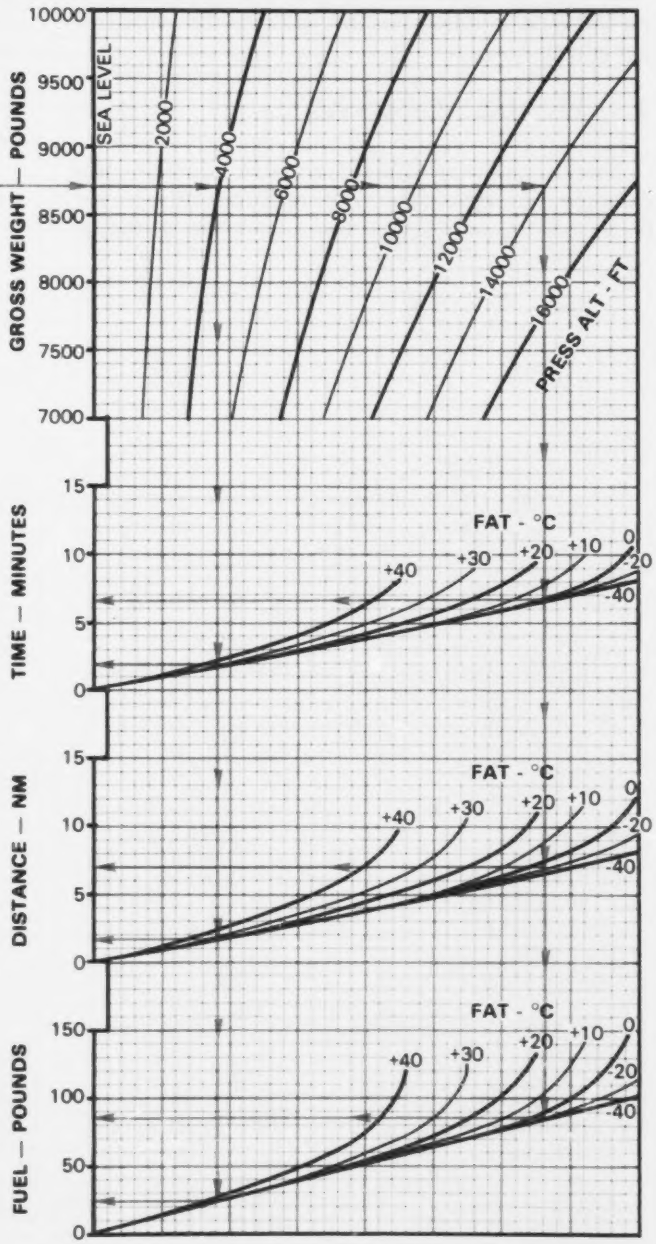
MAXIMUM POWER
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 8700 LBS
INITIAL PRESSURE ALTITUDE = 4000 FT
FINAL PRESSURE ALTITUDE = 14000 FT
INITIAL FAT = 0°C
FINAL FAT ESTIMATED AT -20°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 1.8 MIN
DISTANCE = 1.7 NM
FUEL = 23 LB
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FINAL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 6.5 MIN
DISTANCE = 6.9 NM
FUEL = 85 LB
TIME TO CLIMB = (6.5 — 1.8) = 4.7 MIN
DISTANCE COVERED = (6.9 — 1.7) = 5.2 NM
FUEL USED = (85 — 23) = 62 LB



DATA BASIS: DERIVED FROM FLIGHT TEST

K747 Figure 7.1-10. Climb Performance (Maximum Torque — 30 Minute Operation) Chart

SECTION IX. IDLE FUEL FLOW

7.1-36. DESCRIPTION.

The idle fuel flow chart (figure 7.1-11) shows the fuel flow at engine idle and at flat pitch with 100 percent rpm.

7.1-37. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the idle fuel flow, it is necessary to know the idle condition, pressure altitude, and free air temperature. Enter at the pressure altitude, move right to FAT in appropriate grid, then move down and read fuel flow on the scale corresponding to the condition. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7.1-38. CONDITIONS.

This chart is based on the use of JP-4 fuel.

IDLE FUEL FLOW

JP-4 FUEL

IDLE FUEL FLOW
AH-1S
T53-L-703

EXAMPLE

WANTED

FUEL FLOW AT ENGINE IDLE AND AT 100% RPM WITH FLAT PITCH

KNOWN

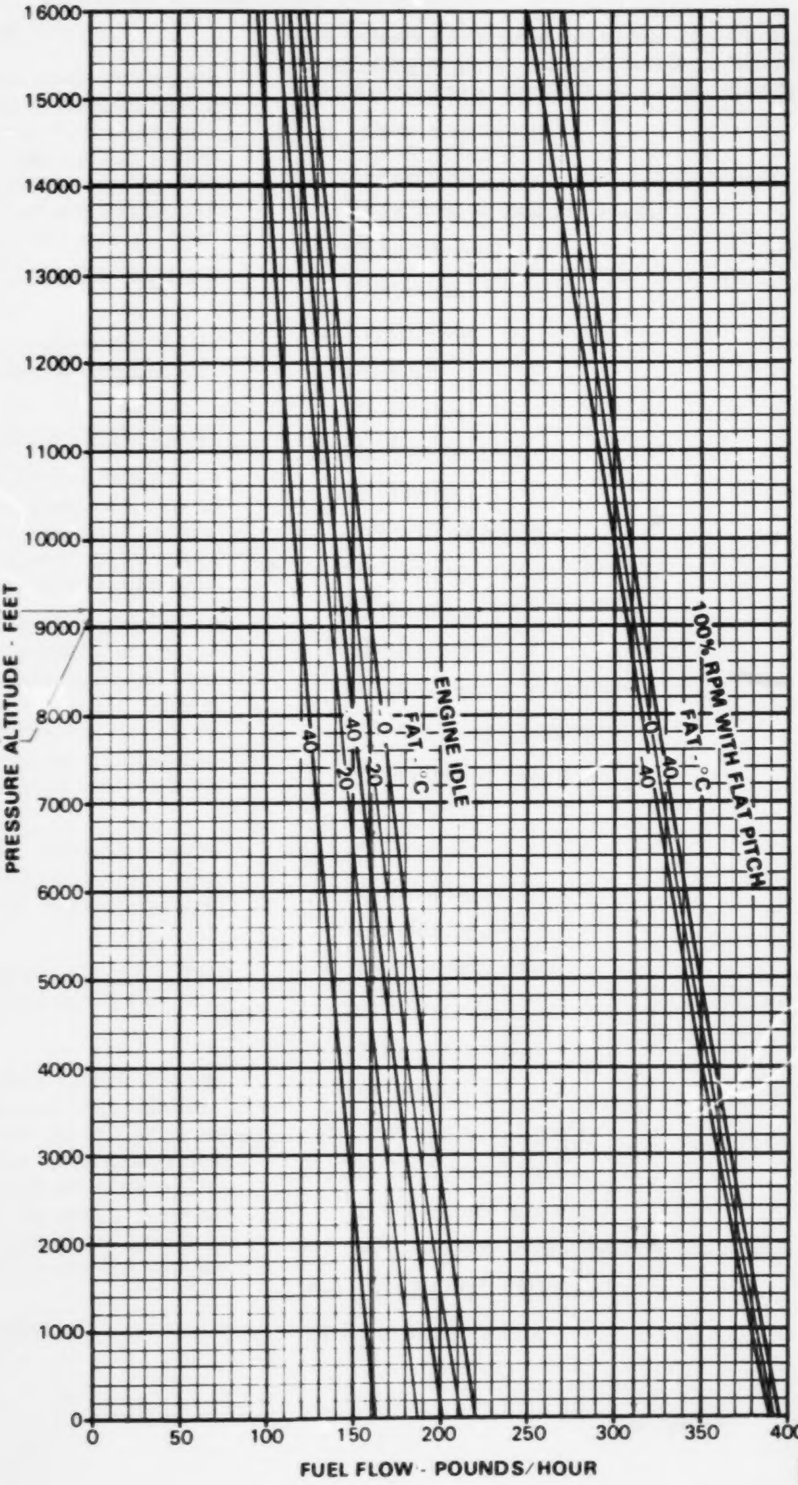
PRESSURE ALTITUDE = 9200 FEET
FAT = 0 C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (ENGINE IDLE) FAT
MOVE DOWN, READ ENGINE IDLE
FUEL FLOW

REENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (100% RPM WITH FLAT PITCH) FAT
MOVE DOWN, READ

FUEL FLOW



DATA BASIS: CALCULATED

Figure 7.1-11. Idle Fuel Flow Chart

CHAPTER 8

NORMAL PROCEDURES

SECTION I. MISSION PLANNING

8-1. MISSION PLANNING.

Mission planning begins when the mission is assigned and extends to the preflight check of the helicopter. It includes, but is not limited to, check of operating limits and restriction; weight/balance and loading; performance; publications; flight plan and crew briefings. The pilot in command shall ensure compliance with the contents of this manual that are applicable to the mission.

8-2. AVIATION LIFE SUPPORT EQUIPMENT (ALSE).

All aviation life support equipment required for misson; e.g., helmets, gloves, survival vests, survival kits, etc., shall be checked.

8-3. CREW DUTIES/RESPONSIBILITIES.

The minimum crew required to fly the helicopter is a pilot. Additional crewmembers, as required, may be added at the discretion of the commander. The manner in which each crewmmember performs his related duties is the responsibility of the pilot in command.

a. Pilot. The pilot in command is responsible for all aspects of mission planning, preflight, and operation of the helicopter. He will assign duties and functions to all other crewmembers as required. Prior to or during preflight, the pilot will brief the crew on the mission, performance data, monitoring of instruments, communications, emergency procedures, and armament procedures.

b. Copilot (when assigned). The copilot must be familiar with the pilot's duties and the duties of the other crew positions. The copilot will assist the pilot as directed.

c. Crew Chief (when assigned). The crew chief will perform all duties as assigned by the pilot.

8-4. CREW BRIEFING.

A crew briefing shall be conducted to ensure a thorough understanding of individual and team responsibilities. The briefing should include, but not be limited to, copilot, mission equipment operator, and ground crew responsibilities and the coordination necessary to complete the mission in the most efficient manner. A review of visual signals is desirable when ground guides do not have a direct voice communications link with the crew.

8-5. PASSENGER BRIEFING.

The following is a guide that should be used in accomplishing required passenger briefings. Items that do not pertain to a specific mission may be omitted.

a. Crew introduction.

b. Equipment.

(1) Personal to include ID tags.

(2) Professional.

(3) Survival.

c. Flight Data.

(1) Route.

(2) Altitude.

(3) Time en route.

(4) Weather.

d. Normal Procedures.

(1) Entry and exit of helicopter.

(2) Seating.

(3) Seat belts.

(4) Movement in helicopter.

(5) Internal communications.

(6) Security of equipment.

(7) Smoking.

(8) Oxygen.

(9) Refueling.

(10) Weapons.

(11) Protective masks.

(12) Parachutes.

(13) Ear protection.

(14) ALSE.

e. Emergency Procedures.

(1) Emergency exits.

(2) Emergency equipment.

(3) Emergency landing/ditching procedures.

8-6. DANGER AREAS.

(Refer to Figure 8-1.)

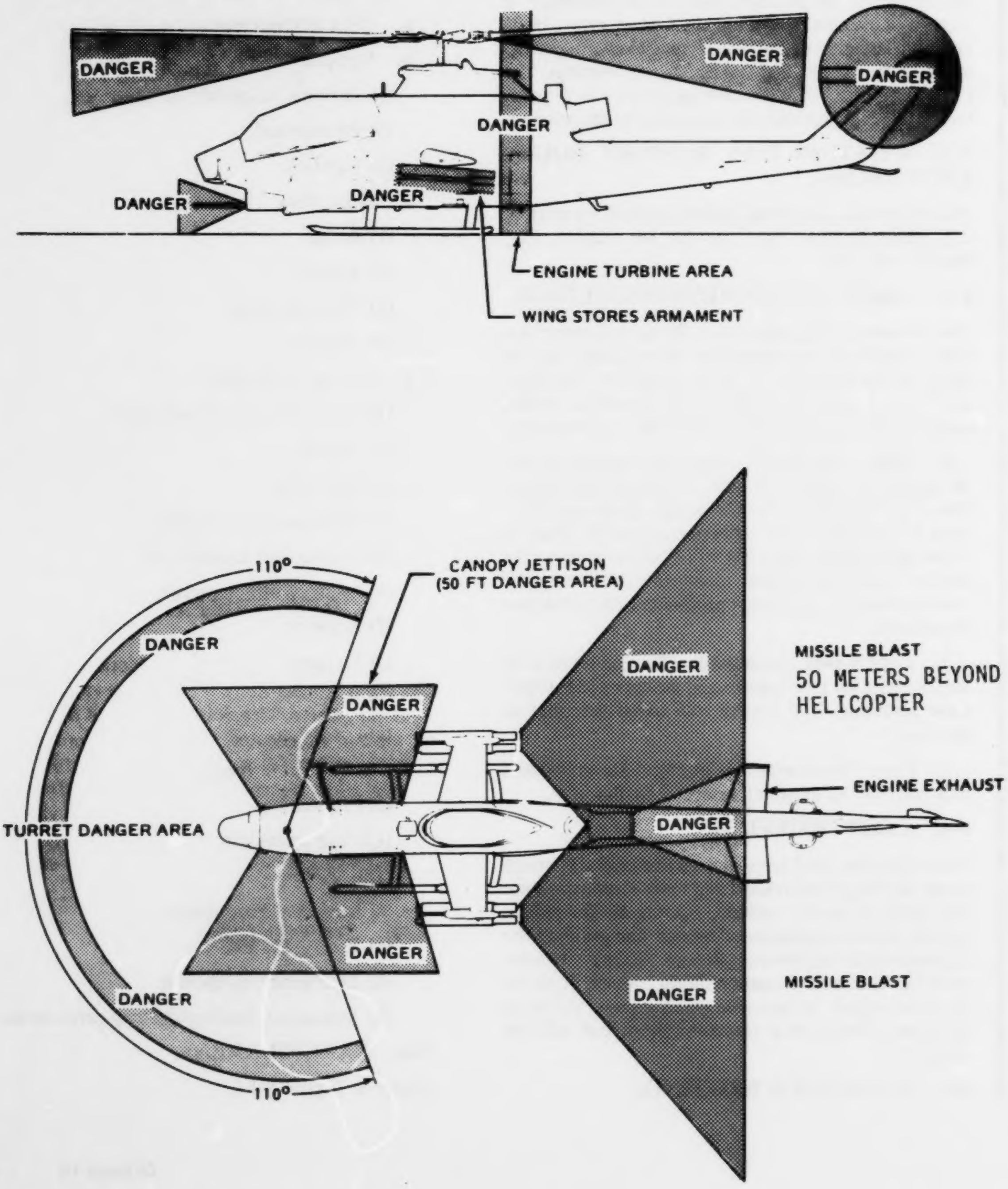

DANGER
DANGER
DANGER
DANGER
DANGER
DANGER
ENGINE TURBINE AREA
WING STORES ARMAMENT
110°
CANOPY JETTISON
(50 FT DANGER AREA)
DANGER
DANGER
DANGER
MISSILE BLAST
50 METERS BEYOND
HELICOPTER
ENGINE EXHAUST
TURRET DANGER AREA
DANGER
DANGER
DANGER
DANGER
MISSILE BLAST
110°

Figure 8-1. Danger Areas

SECTION II. OPERATING PROCEDURES AND MANEUVERS

8-7. OPERATING PROCEDURES AND MANEUVERS.

This section deals with normal procedures and includes all steps necessary to ensure safe and efficient operation of the helicopter from the time a preflight begins until the flight is completed and the helicopter is parked and secured. Unique feel, characteristics, and reaction of the helicopter during various phases of operation and the techniques and procedures used for hovering, takeoff, climb, etc., are described, including precautions to be observed. Your flying experience is recognized; therefore, basic flight principles are avoided. Only the duties of the minimum crew necessary for the actual operation of the helicopter are included.

8-8. MISSION EQUIPMENT CHECKS.

Mission equipment checks are contained in Chapter 4, MISSION EQUIPMENT. Descriptions of functions, operations, and effects of controls are covered in Section IV, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. Checks that must be performed under adverse environmental conditions, such as desert and cold weather operations, supplement normal procedures checks in this section and are covered in Section V, ADVERSE ENVIRONMENTAL CONDITIONS.

8-9. SYMBOLS DEFINITION.

The checklist includes items with annotative indicators immediately preceding the check to which they are pertinent; O to indicate a requirement if the equipment is installed. The symbol ★ indicates that a detailed procedure for the step is located in the performance section of the condensed checklist. When a helicopter is flown on a mission requiring intermediate stops, it is not necessary to perform all of the normal checks. The steps that are essential for safe helicopter operations on intermediate stops are designated as "thru-flight" checks. An asterisk indicates that performance of steps is mandatory for all "thru-flights" when there has been no change in pilot-in-command. The asterisk applies only to checks performed prior to takeoff.

8-10. CHECKLIST.

Normal procedures are given primarily in checklist form and amplified as necessary in accompanying paragraph form when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the Operators and Crewmembers Checklist, TM 55-1520-236-CL.

8-11. PREFLIGHT CHECK.

The pilot's walk-around and interior checks are outlined in the following procedures. The preflight check is not intended to be a detailed mechanical inspection. The steps that are essential for safe helicopter operation are included. The preflight may be made as comprehensive as conditions warrant at the discretion of the pilot.

8-12. BEFORE EXTERIOR CHECKS.

WARNING

Do not preflight until armament systems are safe.

★ *1. Armament systems - Check as follows:

a. Wing ejector racks - Jettison safety pins installed.

b. TOW launcher - Missile arming lever up.

c. Rocket launcher - Igniter arms in contact with rockets.

d. MASTER ARM switch - OFF.

e. PLT ORIDE switch - OFF.

f. JETTISON SELECT switches - OFF.

(O) g. TURRET STOW circuit breaker - OUT.

(O) h. W2P1 - Disconnect.

*2. Canopy removal arming/firing mechanism safety pins - IN.

*3. Publications - Check in accordance with DA PAM 738-751 and any locally required forms and publications.

4. BAT/BATTERY switch - ON/START. A minimum of 22 volts indicates satisfactory condition to attempt battery start.

5. NON-ESNTL BUS switch - MANUAL.

6. Lights - Check if use is anticipated.

7. BAT/BATTERY switch - OFF.

8. Pilot's HSS linkage assembly - Check condition and stow.

9. Area behind pilot seat - Check as follows:

a. First aid kit.

b. Sensor amplifier unit.

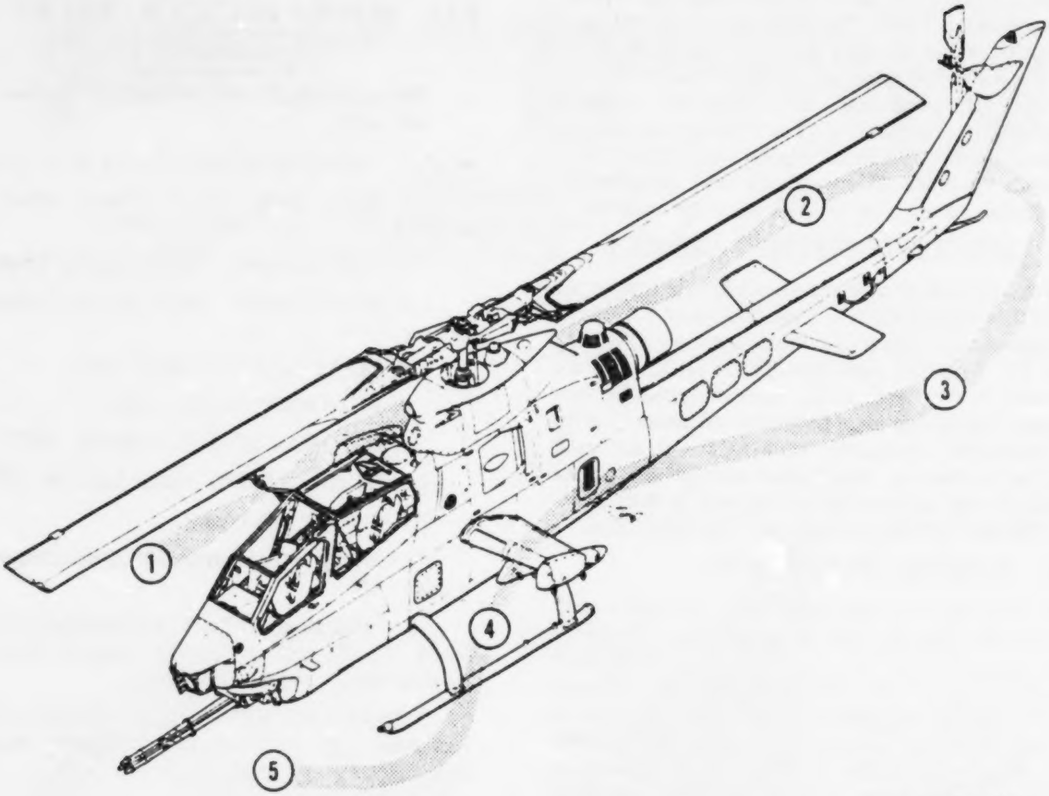
c. HSS interface assembly.

(0) d. Pylon compensator unit.

(0) e. Electronic processing unit.

(0) f. AN/ALQ 136.

10. Map light - OFF.



209478-19C

Figure 8-2. Exterior Check Diagram

209478-19C

Figure 8-2. Exterior Check Diagram

*11. Canopy - Check.

8-13. EXTERIOR CHECK (fig 8-2).

8-14. AREA 1.

*1. Fuel - Check quantity and condition of grounding receptacle. Secure cap.

*2. Fuel sample - Check for contamination before first flight of the day. If the fuel sumps and filter have not been drained, drain and check as follows:

a. Sumps - Drain.

b. BAT/BATTERY switch - ON/START.

c. FUEL switch - FUEL.

d. Filter - Drain.

e. FUEL switch - OFF.

f. BAT/BATTERY switch - OFF.

*3. Main rotor blade/Root end fitting inboard surface - Check.

4. Fuselage - Check as follows:

a. Window Channel Assembly - Check.

b. Static port - Check.

(0) c. Airspeed and direction sensor - Check.

*5. Ammunition bay (right side) - Check condition of door, loading security, and electrical wiring/connections. P Check hydraulic lines and following if installed:

(0) a. Ammunition box - Check.

(0) b. Boost motor - Check.

(0) c. Ammunition chute - Check.

*6. Hydraulic compartment - Check condition of lines, reservoir, cap, and ECS. Check electrical connectors and filter buttons in.

7. Landing gear - Check.

8. Area beneath transmission - Check condition of lines, controls, and electrical connectors. Check emergency hydraulic cap, fluid level, and filter indicator button.

9. Wing - Check.

10. Armament - Check as follows:

(0) a. TOW - Check.

(0) b. Rocket launcher - Check.

(0) c. Wing gun pod - Check.

11. Engine and transmission cowlings - Secure open.

*12. Transmission area - Check hydraulic pumps, lines, servo, transmission oil level, filter button in and main drive shaft.

*13. Pylon access - Check engine oil reservoir, oil level, and electrical connectors.

*14. Swashplate and support - Check.

*15. Main rotor system - Check.

*16. Plenum and particle separator - Check for FOD and check area beneath plenum.

17. Engine comapartment - Check air intake, condition of fuel and oil lines, and fire detector sensing elements. Close cowlings.

18. Fuselage - Check.

8-15. AREA 2.

1. Tailpipe/IR duct assembly - Check.

2. Electrical compartment - Check battery, vents, tailboom attaching bolts for slippage marks and circuit breakers in.

3. Right side tailboom - Check as follows:

a. Air ejector area - Check.

b. Skin - Check.

c. Synchronized elevator - Check.

d. Antennas - Check.

e. Position light - Check.

f. Tail skid - Check.

*4. 42 degree gearbox - Check oil level and cap secure.

*5. Main rotor blade - Check.

*6. Tail rotor - Check.

8-16. AREA 3.

*1. 90-degree gearbox - Check oil level, and cap secure.

2. Left side tailboom - Check as follows:

a. Position light - Check.

b. Tail rotor drive shaft - Check.

c. Skin - Check.

d. Antennas - Check.

e. Synchronized elevator - Check.

f. Air ejector area - Check.

3. Oil cooler compartment - Check.

8-17. AREA 4.

1. Engine and transmission cowling - Secured open. Check engine air intake, condition of fuel and oil lines, fire detector sensing elements, and electrical connectors.

*2. Plenem and particle separator - Check for FOD and area beneath plenum.

3. Tail rotor drive shaft - Check.

4. Transmission area - Check lines, servo, and lift link.

5. Pylon access - Check engine oil reservoir.

6. Swashplate and support - Check.

7. Top pylon area - Check as follows:

a. Anti-collision light - Check.

b. Pitot tube - Check.

c. FM antenna - Check.

d. Upper cutter assembly - Check.

8. Main rotor system - Check.

9. Engine and transmission cowlings - Close.

10. Wing - Check.

11. Armament - Check as follows:

(0) a. TOW - Check.

(0) b. Rocket launcher - Check.

(0) c. Wing gun pod - Check.

12. Area beneath transmission - Check controls and condition of hydraulic, oil, and fuel lines.

13. Landing gear - Check.

14. Lower fuselage - Check as follows:

a. NVG lighting - Check.

b. Searchlight - Check.

c. Lower cutter assembly - Check.

*15. Hydraulic compartment - Check condition of lines, reservoir cap, electrical connectors, and ECS. Check fluid levels and filter buttons in.

16. Canopy - Check. (If single pilot - Perform checks in paragraph 8-20.)

17. Fire extinguisher - Check.

18. Fuselage - Check.

19. Static port - Check.

*20. Ammunition bay (left side) - Check condition of door, electrical connection, hydraulic lines, and LCHR boresight switch - OFF. Check following if installed:

(0) a. Ammunition box - Check.

(0) b. Ammunition chute - Check.

(0) c. Electrical cables/connectors - Check.

8-18. AREA 5.

1. Turret - Check: ■ Refer to Chapter 4, ■ Chapter 4.1, ■, Chapter 4.2.

2. Windshield and rain removal nozzles - Check.

(O) 3. Turret stowed check - Perform.

*8-19. WALK-AROUND CHECK.

1. Cowling, doors, and panels - Secure.

2. Covers, tiedown, and grounding cables - Removed and secured. Rotate main rotor 90 degrees.

(0) 3. Wing store safety pins - Remove.

(0) 4. TOW launchers missile arming lever - Check down.

5. Crew or passenger briefing - Complete.

8-20. BEFORE STARTING ENGINE - GUNNER STATION.

*1. Cockpit - General.

a. Seat belt and shoulder harness - Secure.

b. Loose equipment - Secure.

2. HSS - Check and stow.

*3. Miscellaneous control panel switches - Set as follows:

a. ELEC PWR switch - ELEC PWR.

b. ENG DE-ICE switch - OFF.

c. GOV switch - AUTO.

*4. EMER HYDR PUMP switch - OFF.

*5. JTSN SEL switch - As desired.

*6. WING STORES JETTISON switch - OFF and lockwired.

7. Avionics - As required.

*8. System/flight instruments - Check condition, security and static indications.

*9. Attitude indicator - Caged and locked.

10. Standby compass - Full of fluid and deviation card current.

★ *11. Armament switches - Set as follows:

a. Gunner SHC ACQ/TRK/STOW switch - STOW.

b. Gunner TCP MODE SELECT switch - OFF; system status annunciator displays OFF.

c. Gunner TCP CAMERA switch - OFF.

(O) d. Gunner TCP LASER ARM switch - OFF.

e. Gunner TCP TSU RTCL switch - OFF.

f. Gunner TCP MISSILE SELECT switch - as desired.

g. Gunner RD RMNG indicator/selector - Set.

*h. TUR SLEW switch - NORM.

i. LASER SAFE/TURRET DEPR limit switch - DEPR limit.

j. TSU GUN SLEW RATE switch-HIGH.

12. Map light - OFF.

*13. Canopy removal arming/firing mechanism safety pin - Remove and stow (if occupied).

8-21. BEFORE STARTING ENGINE - PILOT STATION.

*1. IGNITION SW - ON.

*2. Collective friction and lock - OFF.

*3. AC circuit breakers - As required (M FCC switch OFF and ADS PWR - Out.)

4. PWR panel switches - Set as follows:

*a. BAT/BATTERY switch - ON/START.

b. GEN switch - OFF.

c. INV/ALTNR switch - OFF.

d. NON ESNTL BUS switch - As desired.

*5. MASTER CAUTION and RPM warning lights - Check illuminated.

*6. Caution panel lights - TEST. (Check overtorque light illuminated and RESET MASTER caution light.)

7. ENGINE panel switches - Set as follows:

a. ENG DEICE switch - OFF.

b. FORCE TRIM switch - FORCE TRIM.

c. HYD TEST switch - Centered (Both systems on).

*d. FUEL switch - ON.

e. ENG OIL BYP switch - AUTO.

f. GOV switch - AUTO.

8. FAT indicator - Check condition.

9. SCAS POWER switch - OFF.

★ 10. Armament switches - Set as follows:

(0) *a. RMS - Set.

b. WPNS CONTR - Gunner.

c. WING STORE - As desired.

(0) d. RECOIL COMPEN - As desired.

e. Range - As desired.

11. CODE HOLD switch - OFF.

12. EMER HYDR PUMP - Check as follows:

a. EMER HYDR PUMP switch - EMER HYDR PUMP. Caution light illuminates.

b. Collective pitch - Raise. Any movement of the collective is sufficient to confirm hydraulic power. Place collective pitch full down.

c. EMER HYDR PUMP switch - OFF. Caution light extinguishes.

13. System/flight instruments - Check condition, security and static indications.

*14. Altimeter - Set.

*15. FIRE DET TEST switch - TEST.

(0) 16. Reflex sight - Check condition.

(0) 17. HUD - OFF; Check condition.

(0) 18. Pilot steering indicator - Check indication.

19. Clock -Set.

20. HEAT/VENT AIR PULL knob - Out and vents adjust.

21. Avionics/mission equipment - OFF; set as desired.

22. COMPASS switch - MAG.

*23. LTG panel switches - Set as required.

24. ECS panel switches - Set as required.

*25. DC Circuit breakers - In.

*26. Canopy removal arming/firing mechanism safety pin - Remove and stow.

*8-22. STARTING ENGINE.

WARNING

When helicopter is armed with rockets, make start with battery only, because it is hazardous to place GPU (or any electrical generating equipment) in close proximity due to danger of accidental firing of rockets.

1. GPU - Connect if GPU starting. (P BAT switch - OFF.)

2. Fireguard - Posted if available.

3. Rotor blades - Check clear and untied.

4. Throttle - Check and set for start.

★ 5. Engine - Start as follows:

a. Start switch - Press and hold (start time).

b. DC voltmeter - Check indication. Battery starts can be made provided the voltage is not below 14 volts when cranking through 10 percent N1 speed.

c. Main rotor - Check turning as N1 reaches 15 percent. If not, abort the start.

d. Start switch - Release at 40 percent (N1) or after 35 seconds, whichever occurs first.

e. IGNITION SW - OFF, at 750 degrees C TGT.

f. Throttle - Slowly advance past the engine idle stop to engine idle position. Check stop by attempting to roll throttle off.

g. N1 - Check 68 percent to 72 percent. Hold a slight pressure against the idle stop during this check.

h. IGNITION SW - ON after TGT has stabilized.

6. GEN switch - ON, check ammeter indication and DC GEN caution light out.

7. GPU - Disconnect after GPU start.

8. BAT/BATTERY switch - ON/RUN.

9. P INV switch - STBY for first flight of day and MAIN for thru-flight.

10. Systems - Check as follows:

a. Engine and transmission oil pressures - Check.

b. Caution lights - Check off. (E/M ALTER and RECT lights are ON.)

c. Ammeter - Check less than 200 amps.

CAUTION

Oil pressure may exceed maximum on low ambient temperature starts. Do not exceed engine idle until engine oil pressure is below 100 psi.

8-23. ENGINE RUNUP.

CAUTION

Minimize movement of the cyclic during ground runup to preclude damage to the input quill seal and the main driveshaft.

*1. Avionics/mission equipment - On as desired.

*2. SCAS POWER switch - POWER (check NO-GO lights illuminate and remain on for approximately 10 seconds, then extinguish prior to 30 seconds).

3. Hydraulic system - Check as follows:

a. FORCE TRIM switch - OFF.

b. HYD TEST switch - SYS 1 (system 2 out); MASTER CAUTION and #2 HYD/HYDR PRESS caution lights should illuminate; all controls should be free.

c. HYD TEST switch - SYS 2 (system 1 out), MASTER CAUTION and #1 HYD/HYDR PRESS caution lights should illuminate, pedals should be stiff, cyclic and collective free.

d. HYD TEST switch - Center position, #1 and #2 HYD/HYDR PRESS caution lights should be out.

e. FORCE TRIM switch - FORCE TRIM.

*4. Canopy doors - Secure.

*5. Throttle - 100%. As throttle is increased, the low rpm audio and warning light should be off at 94 ±1% engine and rotor rpm. Throttle friction as desired.

6. Deleted.

*7. Systems - Check as follows:

a. Fuel quantity - Check and depress FUEL GAGE TEST switch.

b. Engine instruments - Check.

c. Transmission instruments - Check.

d. DC voltmeter - Check at 27.5 ± 0.25 volts.

e. Pitot heater - Check as required.

f. ENG DEICE switch - Check as required.

g. [redacted] ALTNR switch - ON (ALTER and RECT lights out).

NOTE

Alternator should be left off during any maneuvers (emergency tasks) requiring multiple cycles through 91 percent.

*8. SCAS - Check as follows:

a. NO-GO lights - Check out.

NOTE

If the mechanically dimmable NO-GO lights are dimmed, a false indication could result in engagement of SCAS with an out-of-null condition.

b. Engage PITCH, ROLL, and YAW channels one at a time and visually check around the helicopter. Have hand on the cyclic stick, and be prepared to immediately press the SAS REL switch if any abnormal tip path or control fluctuations are noted.

c. Press SAS REL switch on gunner's cyclic and pilot checks channels are OFF.

d. Pilot checks NO-GO lights are out and reengages PITCH, ROLL, and YAW channels; then, press the SAS REL switch on his cyclic. Check channels are OFF.

e. Pilot checks NO-GO lights are out and reengages PITCH, ROLL, and YAW channels.

★ *9. Armament systems - Set as follows:

a. MASTER ARM - STBY.
b. TCP Switch - STBY TOW.
c. HUD PWR Switch - STBY.
d. TURRET DRIVE MOTOR Circuit breaker - IN.
e. ADS PWR Circuit breaker - IN.
f. FCC Switch - FCC.

*10. Avionics/mission equipment - Check and set as required.

*11. Altimeters - Set the radar altimeter and current barometric pressure.

*12. HSI - Corresponds with standby compass. Set as required.

*13. ADI - Set.

★ 14. Armament systems - Check as follows:

a. HSS BIT - Check.

b. HSS to turret - Check.

c. HSS to TSU - Check.

d. TOW BIT - Check.

e. TSU fast rate tracking - Check.

f. TSU slow rate tracking - Check.

g. TSU motion compensation - Check.

h. TSU to turret - Check.

(O) i. RMS BIT - Check.

(O) j. HUD - Check.

(O) k. M73 sight - ON/Check.

15. Health Indicator Test (HIT) check - Perform as required on first flight of the day.

★*16. Armament switches - Set as follows:

a. Gunner PLT ORIDE switch - OFF.

b. Pilot MASTER ARM switch - STBY.

c. TCP - TSU/GUN.

d. TOW launchers - Missile arming lever down.

e. Other switches - Set for mission requirements.

f. Wing ejector rack jettison safety pins Removed.

*8-24. HOVER CHECK.

Perform the following checks at a hover.

1. Flight controls - Check for correct position and response.

2. Engine and transmission instruments - Check.

3. Flight instruments - Check as required.

a. Airspeed indicator - Check airspeed.

b. ADI - Indicates nose high or low and banks left and right.

c. VSI and altimeter - Indicates climb and descent.

d. Slip indicator - Ball free in race.

e. Turn needle, HSI, and magnetic compass indicate turns left and right.

4. Power - Check. The power check is performed by comparing the indicated torque required to hover with the predicted values from performance charts.

*8-25. BEFORE TAKEOFF.

1. RPM - 100 percent.

2. Systems - Check engine, transmission, electrical, and fuel systems indications.

3. Avionics - As required.

4. Mission equipment - Set as required.

5. Armament switches - Set.

8-26. MAXIMUM PERFORMANCE.

A takeoff that demands maximum performance from the helicopter is necessary because of various combinations of heavy helicopter loads, restricted performance due to high density altitudes, barriers that must be cleared and other terrain features. The decision to use either of the following takeoff techniques must be based on an evaluation of the conditions and helicopter performance.

a. Coordinated Climb (maximum performance). Align the helicopter with the desired takeoff course at a stabilized hover of approximately 3 feet (skid height). Apply forward cyclic smoothly and gradually while simultaneously increasing collective pitch to begin a coordinated acceleration and climb. Adjust pedal as necessary to maintain the desired heading. Maximum torque available should be applied (without exceeding helicopter limits) as the helicopter attitude is established that will permit safe obstacle clearance. The climbout is continued at the attitude and power setting until the obstacle is cleared. After the obstacle is cleared, adjust helicopter attitude and collective pitch as required to establish a climb at the desired rate and airspeed. Continuous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. Take off may be made from the ground by positioning the cyclic control slightly forward of neutral prior to increasing collective pitch.

b. Level Acceleration. Align the helicopter with takeoff course at a stabilized hover of approximately 3 feet (skid height). Apply forward cyclic smoothly and gradually while simultaneously increasing collective pitch to begin an acceleration at approximately 3 to 5 feet skid height. Adjust pedal to maintain heading. Maximum torque available should be applied (without exceeding helicopter limits) prior to accelerating through effective translational lift. Additional forward cyclic pressure will be necessary to allow for level acceleration to the desired climb airspeed. Approximately 5 knots prior to reaching the desired climb airspeed, gradually release forward cyclic pressure and allow the helicopter to begin a constant airspeed climb to clear the obstacle. Care must be taken not to decrease airspeed during the climbout since this may result in the helicopter descending. After the obstacle is cleared, adjust helicopter attitude and collective pitch as required to establish desired rate of climb and airspeed. Continuous coordinated application of control is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. Takeoff may be made from the ground by positioning the cyclic control slightly forward of neutral prior to increasing collective pitch.

c. The two techniques give approximately the same distance over a 50-foot obstacle when the helicopter can just hover OGE. As hover capability is decreased, the level acceleration technique gives increasingly shorter distances than the coordinated climb technique. Where the two techniques yield the same distance over a 50-foot obstacle, the coordinated climb technique will give a shorter distance over lower obstalces and the level acceleration technique will give a shorter distance over obstacles higher than 50 feet. In addition to the distance comparison, the main advantages of the level acceleration technique are as follows: (1) It requires less or no time in the avoid area of the height velocity diagram; (2) performance is more repeatable; (3) at the higher climbout airspeeds (30 knots or more), reliable indicated airspeeds are available for accurate airspeed reference from the beginning of the climbout, therefore minimizing the possibility of fall-through. The main advantage of the coordinated climb techinque is that the climb angle is established early in the takeoff and more distance and more time are available to abort the takeoff if the obstacle cannot be cleared.

8-27. BEFORE LANDING.

1. Gunner PLT ORIDE Switch OFF.
2. MASTER ARM Switch - STBY.
3. TCP - TSU/GUN.
4. TURRET DRIVE MOTOR Circuit breaker - OUT.
5. Searchlight - As required.

8-28. AFTER LANDING.

1. Searchlight - As required.

2. Transponder - As required.

8-29. ENGINE SHUTDOWN.

1. Throttle - Reduce to idle. Allow TGT to stabilize for two minutes.

2. FORCE TRIM switch - FORCE TRIM.

★ 3. Armament systems - OFF and set as follows:

(O) a. FCC switch - OFF.
(O) b. ADS PWR circuit breaker - out.
(O) c. TURRET STOW circuit breaker - out.
d. TCP switch - OFF.
e. MASTER ARM switch - OFF.
(O) f. HUD night filter - DAY position.
g. HUD PWR switch - OFF.
(O) h. [illegible] M73 sight - OFF.
i. LASER SAFE/TURRET DEPR LIMIT switch - DEPR LIMIT.
j. TUR SLEW switch - GND TEST/SLOW.
k. HSS linkage - STOW.

4. Systems - Check and turn off as follows:

a. ENG DEICE switch - OFF.

b. SCAS POWER switch - OFF.

c. ECS panel switches - OFF.

d. Engine, transmission, and electrical indications - Check indications.

e. Avionics/Mission equipment - OFF.

f. Lights - Set as required.

g. Gunner's attitude indictor - Cage.

5. Throttle - OFF.

6. Engine and PWR panel switches - Set as follows:

a. FUEL switch - OFF.

b. INV/ALTNR switch - OFF/OFF RESET.

c. GEN switch - OFF.

d. BAT/BATTERY switch - OFF.

7. IGNITION SW - OFF. Remove key as required.

8. Both canopy removal arming/firing mechanism safety pins - In.

8-30. BEFORE LEAVING HELICOPTER.

WARNING

When helicopter is to be parked where ambient temperature equals or exceeds 32 degrees C, the fire extinguisher shall be removed until the next mission.

1. Post flight check - Check for damage, fluid leaks and levels.

2. Mission equipment - Secure.

★ 3. All armament - Check as follows:

a. Wing ejector rack jettison safety pins Installed.

b. TOW missile arming lever - Up (if missiles are installed).

c. Rocker igniter arms - In contact with rockets to reduce possibility of ignition from electromagnetic interference (EMI).

4. Complete all forms and records. An entry on DA Form 2408-13 is required if any of the following conditions were experienced:

a. Flown in a loose grass environment.

b. Operated within 10 nautical miles of salt water.

c. Operated within 200 nautical miles of volcanic activity.

d. Exposed to radioactivity.

5. Secure helicopter.

Section III. INSTRUMENT FLIGHT

8-31. INSTRUMENT FLIGHT PROCEDURES.

This helicopter is not qualified for operation under instrument metrorological conditions although adequate navigation and communications equipment are installed for instrument flight. Flight characteristics and range are the same during instrument flight conditions as operations in visual flight conditions. Refer to FM 1-240, FM 1-300, AR 95-1, and FAR Part 91 for instrument flight rules and weather information.

Section IV. FLIGHT CHARACTERISTICS

8-32. OPERATING CHARACTERISTICS.

The flight characteristics of this helicopter, in general, are similar to other single rotor helicopters.

8-33. ROLLOVER CHARACTERISTICS.

Refer to FM 1-203, Fundamentals of Flight.

8-34. BLADE STALL.

a. General. In forward flight, some portions of the rotor disk swept by the retreating blade are always stalled. How this stalled area affects the performance and flying qualities depends on the size of the stalled area. The size of the stalled area increases with increase in gross weight, airspeed, density altitude, "g" loading, or with a decrease in rpm. The rolling and pitching motion which is often associated with rotor stall will not occur.

b. Stall Recognition. The pilot will notice a progressive increase in vertical vibration level, mostly at 2 per rev, as more of the rotor disk becomes stalled. An increase in any of the above stall-inducing factors will result in higher 2 per rev vibration and eventually the onset of control force feedback. Both the 2 per rev vibration and feedback forces will be progressively greater as blade stall affects more of the rotor area. Because of the progressive nature of blade stall with this rotor system, there is not abrupt threshold or onset of rotor stall and therefore no meaningful "stall limit" exists.

c. Stall Reduction.

(1) The amount of stall and associated vibration encountered may be reduced by reducing collective.

(2) Reducing the g loading of the maneuver may be accomplished by applying:

(a) Forward cyclic.

(b) Reducing airspeed.

(c) Increasing operating rpm.

(d) Reducing altitude.

8-35. CONTROL FEEDBACK.

a. Feedback in the cyclic stick or collective stick is caused by high loads in the control system. These loads are generated during severe maneuvers and can be of sufficient magnitude to overpower or feed through the main boost cylinders and into the cyclic and/or collective stick. The pilot will feed this feedback as an oscillatory "shaking" of the controls even though he may not be making control inputs after the maneuver is established. This type of feedback will normally vary with the severity of the maneuver. The pilot should regard it as a cue that high control system loads are occurring and should immediately reduce the severity of the maneuver.

b. The gunner station side arm flight controls are designed for emergency conditions and have a reduced mechanical advantage. Because of this reduced mechanical advantage of the gunner's cyclic and collective control, severe maneuvers should be avoided while flying from the gunner station.

8-36. DIVING FLIGHT.

WARNING

If an abrupt recovery is attempted at speeds near VNE, "mushing" of the helicopter can occur. If mushing is experienced, do not increase collective, as this will aggravate the condition. Figure 8-3 depicts the altitude lost during a pullout rate of descent for various g loadings.

Diving flight presents no particular problems in the helicopter; however, the pilot should have a good understanding of such things as rates of descent versus airspeed, rate of closure, and rates of descent versus power. The helicopter gains airspeed quite rapidly in a dive and it is fairly easy to exceed VNE. Rates of descent of 3500 ft./min. to 4800 ft./min. are not uncommon during high-speed dives. High rates of descent coupled with high flight path speeds require that the pilot monitor both rate of closure and terrain features very closely and plan his dive recovery in time to avoid having to make an abrupt recovery.

8-37. POWER DIVES.

At speeds above the maximum level flight speed, the rate of descent will increase approximately 1000 ft./min. for every 10 knots increase in airspeed for the full power condition.

8-38. PITCH CONE COUPLING.

a. Pitch cone coupling is the characteristic of the rotor to inherently reduce blade pitch with increasing coning under loading which aids to maintain rpm and retard blade shall. With severe rotor loading, the rotor rpm may overspeed above the red line unless collective pitch is increased.

b. When g load is placed upon the rotor system through steep turns, dive recoveries, or other high-stress maneuvers, the rotor blades cone upward. Most of the inherent bending action is absorbed by the flexible yoke assembly. As the hub bends, the pitch change horns exert a downward pressure on the pitch control tubes. The control tubes, however, are fixed through the control system and are unable to move. As pressure continues to be applied, the leading edge of the blade begins to rotate downward via the feather bearing. This directly reduces pitch in the blades which in turn acts to increase rotor rpm. As the rotor rpm begins to increase, the N2 governor senses the change and begins to decrease engine power, resulting in a corresponding decrease in torque and N1. When performing g maneuvers, maintaining a constant torque setting is of prime importance in preventing overspeeding of the rotor.

8-39. TRANSIENT TORQUE.

a. Transient torque, although evident in all semi-rigid single-rotor system helicopters, is a phenomenon which is quite pronounced in the AH-1P/E/F. With a rapid application of left lateral cyclic, a rapid torque increase followed by a decrease will be evidenced. This condition occurs as a result of temporary increased induced drag being placed on the rotor system by the additional pitch in the advancing blade.

b. With a rapid application of right lateral cyclic,

DIVE RECOVERY DISTANCE

EXAMPLE

WANTED

ALTITUDE LOST

KNOWN

RATE OF DESCENT 2000
FEET PER MINUTE
"G" LOAD OF 1.2

METHOD

MOVE RIGHT FROM 2000
FEET AND INTERSECT
1.2 "G" LINE. MOVE
DOWN TO READ 125 FEET

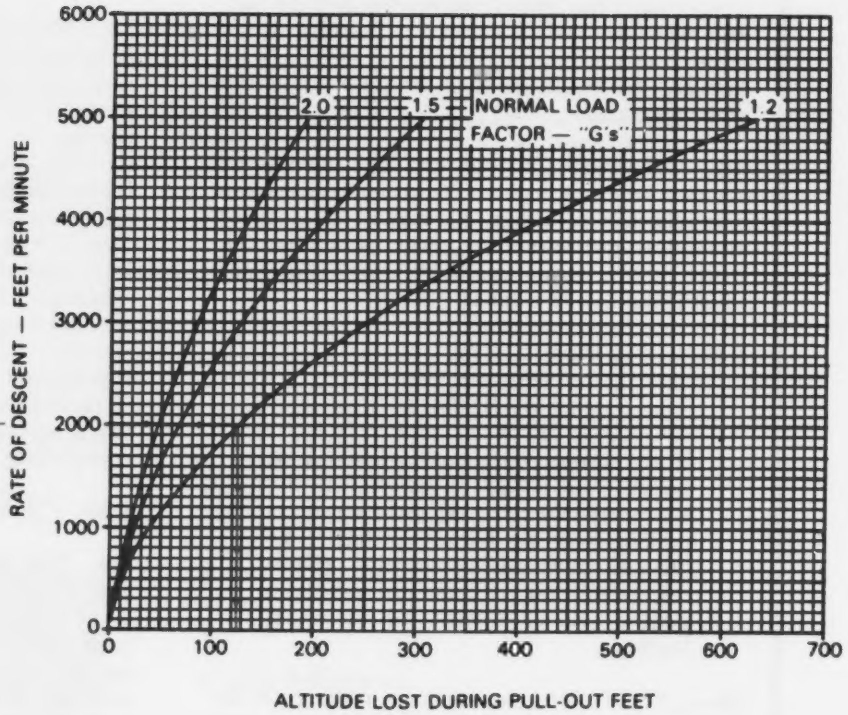


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Figure 8-3. Dive recovery distances

a rapid torque decrease followed by an increase will be evidenced. This condition occurs as a result of drag being reduced in the rotor system due to the reducing of pitch in the advancing blade, which temporarily decreases the blade's resistance to the airflow. Increasing and decreasing rotor system drag will produce corresponding torque changes due to the fact that the rotor system's requirement for an increase or decrease in power is sensed and subsequently supplied by the fuel control system. As airspeed and severity of the maneuver are increased, the transient torque effect is also increased. The pilot should become familiar with this characteristic and form a natural tendency to compensate with collective control to avoid exceeding the helicoper torque and rotor rpm limitations.

8-40. MANEUVERING FLIGHT.

During left rolling maneuvers or high power dives, torque increases occur. To prevent main transmission overtorque, care must be exercised in monitoring torque pressure to enable the pilot to reduce power as required to prevent overtorque.

8-41. LOW G MANEUVERS.

WARNING

Intentional flight below + 0.5 "g's" is prohibited.

Abrupt inputs of the flight controls cause excessive main rotor flapping, which may result in mast bumping and must be avoided.

If an abrupt right roll should occur when rapidly lowering the nose, PULL IN AFT CYCLIC to stop the rate and effect recovery. Left lateral cyclic WILL NOT effect recovery from a well-developed right roll during flight at less than one g, and it may cause severe main rotor flapping. DO NOT move collective or directional controls or disengage the SCAS during recovery.

a. Because of mission requirements, it may be necessary to rapidly lower the nose of the helicopter in order to (1) acquire a target; (2) stay on target; or (3) recover from a pullup. At moderate to high airspeeds, it becomes increasingly easy to approach zero or negative load factors by abrupt forward cyclic inputs. The helicopter may exhibit a tendency to roll to the right simultaneously with the forward cyclic input; this characteristic being most pronounced when roll SCAS is disengaged.

b. Such things as sideslip, weight and location of wing stores and airspeed will affect the severity of the right roll. Variances in gross weight, longitudinal cg, and rotor rpm may affect the roll characteristics. The right roll occurs throughout the normal operating airspeed range and becomes more violent at progressively lower load factors.

NOTE

When it is necessary to rapidly lower the nose of the helicopter, it is essential that the pilot monitor changes in roll attitude as the cyclic is moved forward.

8-42. SETTLING WITH POWER.

Refer to FM 1-203, Fundamentals of Flight.

8-43. ROTOR RPM - POWER OFF.

The following steps list the factors which affect power-off rotor rpm.

a. Airspeed. In autorotation, rotor rpm varies with airspeed. Maximum rotor rpm is achieved at a steady state of 60 to 80 knots (Figure 8-4). Rotor rpm decreases at stabilized airspeeds above or below 60- to 80-knot range. When changing airspeeds, cyclic movement will produce a rotor rpm other than that produced under steady-state conditions as follows:

(1) From low airspeed. Example: From a stabilized 30-knot autorotative condition, a positive forward cyclic movement to increase airspeed will cause the rotor rpm to decrease initially and then increase when the helicopter is stabilized at the higher speed.

(2) From high airspeed. Example: From a stabilized 120 KIAS autorotative condition, a positive aft cyclic movement to decrease airspeed will cause the rotor rpm to increase initially and then decrease when the helicopter is stabilized at the lower speed.

b. Gross Weight. The power-off rotor rpm varies significantly with gross weight. A low gross weight will produce a low rotor rpm. A high gross weight will produce a high rotor rpm. With the collective system cor-

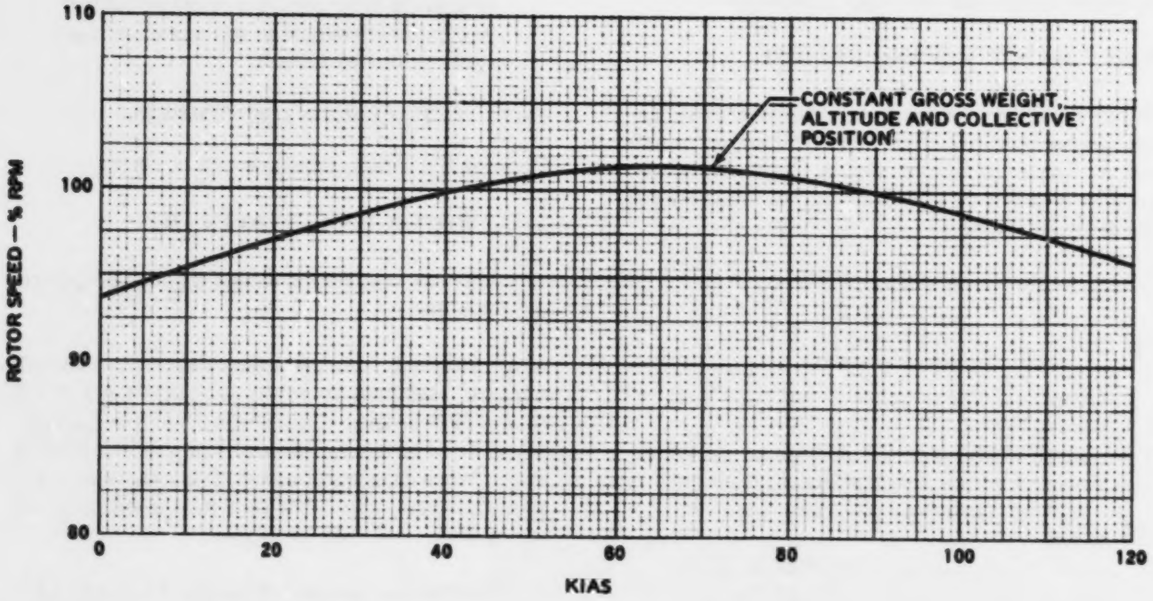


Figure 8-4. Main Rotor RPM Versus Airspeed (Power Off)

rectly rigged to a minimum blade angle (full down collective stick), the pilot must manually control rpm with the collective stick in order to prevent overspeed of the rotor when at high gross weight.

8-44. AUTOROTATION CHARACTERISTICS.

a. The K747 main rotor blades have a greater tendency to overspeed in autorotation than the B540 main rotor blades.

b. Refer to FM 1-230, Fundamentals of Flight, Section IV, Autorotation.

8-45. MAST BUMPING.

WARNING

Abrupt inputs of the flight controls cause excessive main rotor flapping, which may result in mast bumping and must be avoided.

a. Mast bumping (flapping-stop contact) is the main rotor yoke contacting the mast. It may occur during slope landings, rotor start-up/coast-down, or when the approved flight envelope is exceeded. If mast bumping is encountered in flight, land as soon as possible.

(1) If mast bumping occurs during a slope landing, reposition the cyclic control to stop the bumping and reestablish a hover.

(2) If mast bumping occurs during start-up or shutdown, move cyclic to minimize or eliminate bumping.

(3) If mast bumping occurs during rearward or sideward flight, move cyclic slightly toward center position and apply pedal to bring the nose into a relative wind.

b. Because of mission requirements, it may be necessary to rapidly lower the nose of the helicopter with cyclic input or make a rapid collective reduction. At moderate to high airspeeds, it becomes increasingly easy to approach less than + 0.5 "g's" by abrupt forward cyclic inputs. Variance in such things as sideslip, airspeed, gross weight, density altitude, center of gravity, and rotor speed may increase main rotor flapping and increase the probability of mast bumping. Rotor flapping is a normal part of maneuvering and excessive flapping can occur at greater than 1 "g" flight; but, flapping becomes more excessive for many given maneuvers at progressively lower load factors.

(1) In the event of loss of all engine power at high speed, aft cyclic must be applied to maintain rotor rpm and to avoid mast bumping during autorotation entry.

(2) If the flight envelop is inadvertently exceeded by low g flight (below +0.5g), move the cyclic aft to regain positive thrust on the rotor before correcting rolling tendencies.

Section V. ADVERSE ENVIRONMENTAL CONDITIONS

8-46. GENERAL.

This section provides information relative to operation under adverse environmental conditions (snow, ice and rain, turbulent air, extreme cold and hot weather, desert operations, mountainous and altitude operation) at maximum gross weight.

8-47. COLD WEATHER OPERATIONS.

Operation of the helicopter in cold weather or an arctic environment presents no unusual problems if the operators are aware of those changes that do take place and conditions that may exist because of the lower temperatures and freezing moisture.

a. Inspection. The pilot must be more thorough in the walk-around check when temperatures have been at or below 0 degrees C (32 degrees F). Water and snow may have entered many parts during operations or in periods when the helicopter was parked unsheltered. This moisture often remains to form ice which will immobilize moving parts or damage structure by expansion and will occasionally foul electric circuitry. Protection covers afford majority protection against rain, freezing rain, sleet, and snow when installed on a dry helicopter prior to precipitaion. Since it is not practical to completely cover an unsheltered helicopter, those parts not protected by covers and those adjacent to cover overlap and joints require closer attention, especially after a blowing snow or freezing rain. Accumulation of snow and ice should be removed prior to flight. Failure to do so can result in hazardous flight, due to aerodynamic and center of gravity disturbances as well as the introduction of snow, water, and ice into internal moving parts and electrical systems. The pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

CAUTION

At temperatures of -35 degrees C (-31 degrees F) and lower, the grease in the spherical couplings of the main and tail rotor transmission driveshafts and tailrotor driveshaft coupling may congeal to a point that the couplings cannot operate properly. If temperature is -44 degrees C (-47 degrees F) or below the pilot must be particularly careful to monitor engine instruments for high oil pressure.

b. Transmission. Check for proper operation by turning the main rotor opposite to the direction while an observer watches the driveshaft to see that there is no tendency for the transmission to "wobble" while the driveshaft is turning. If found frozen, apply heat (do not use open flame and avoid overheating boot) to thaw the spherical couplings before attempting to start engine.

c. Checks.

(1) Before exterior check 0 degrees C (32 degrees F) and lower. Perform check as specified in Section II.

(2) Exterior check 0 degrees C (32 degrees F) to -54 degrees C (-65 degrees F). Perform exterior check as outlined in Section II, plus the following checks.

(a) Surfaces and controls - Check free of ice and snow. Deicing fluid or heat should be used to remove ice.

(b) Fluid levels - Check contraction of the fluids in the helicopter system at extreme low temperature causing indication of low levels. A check made just after the previous shutdown and carried forward to the walk-around check is satisfactory if no leaks are in evidence. Filling when the system is cold-soaked will reveal an over-full condition immediately after flight, with the possibility of forced leaks at seals.

(c) Engine Air Inlet - Remove all loose snow that could be pulled into and block the engine intake during starting.

(3) Interior check - All flights 0 degrees C (32 degrees F) to -54 degrees C (-65 degrees F). Perform check as specified in Section II.

(4) Interior check - Night flights 0 degrees C (32 degrees F) to -54 degrees C (-65 degrees F). Perform check as specified in Section II.

(5) Engine starting check - 0 degrees C (32 degrees F) to -54 degrees C (-65 degrees F).

CAUTION

As the engine cools to an ambient temperature below 0 degrees C (32 degrees F) after engine shutdown, condensed moisture may freeze engine seals. Ducting hot air from an external source through the air inlet housing will free a frozen rotor. Perform check as outlined in Section II. During cold weather, starting the engine, oil pressure gage will indicate maximum (100 psi). The engine should be warmed up at engine idle until the engine oil pressure indication is below 100 psi.

(6) Hydraulic filter indicators - Reset if popped out.

(7) Engine runup check. Peform the check as outlined in Section II.

WARNING

Control system checks should be performed with extreme caution when helicopter is parked on snow and ice. There is reduction in ground friction holding the helicopter stationary, controls are sensitive and response is immediate.

d. Engine Starting Without External Power Supply. If a battery start must be attempted when the helicopter and battery have been cold-soaked at temperatures between -26 degrees C to -37 degrees C (-15 degrees F to -35 degrees F), preheat the engine and battery if equipment is available and time permits. Preheating will result in a faster starter cranking speed which tends to reduce hot start hazard by assisting the engine to reach a self-sustaining speed (40 percent N1) in the least possible time.

8-48. SNOW.

Refer to FM 1-202, Environmental Flight.

8-49. DESERT AND HOT WEATHER OPERATION.

Refer to FM 1-202, Environmental Flight.

8-50. TURBULENCE AND THUNDERSTORMS.

Flight in thunderstorms and heavy rain which accompanies thunderstorms should be avoided. If turbulence and thunderstorms are encountered inadvertently, use the following procedures:

a. Check that safety belts and harnesses are tightened.

b. PITOT HTR - ON.

c. Power - Adjust to maintain a penetration speed of 100 KIAS or VNE whichever is slower.

d. Radios - Turn volume down on any radio equipment badly affected by static.

e. At night - Turn interior lights to full bright to minimize blinding effect of lightning.

f. Maintain a level attitude and constant power setting. Airspeed fluctuations should be expected and disregarded.

g. Maintain the original heading, turning only when necessary.

h. The altimeter is unreliable due to differential barometric pressures within the storm. An indicated gain or loss of several hundred feet is not uncommon and should be allowed for in determining minimum safe altitude.

8-51. ICING CONDITIONS.

WARNING

Intentional flight in known icing condition is prohibited. If icing conditions are encountered during flight, every effort should be made to vacate the icing environment.

Firing of aircraft weapons in icing conditions is prohibited. The weapons covered are: TOW missile, 2,75 inch FFAR, 40MM Grenade Launcher, 20 MM gun, and 7.62MM MG. A very serious safety hazard exists if aircraft weapons are fired in icing weather conditions. The TOW missile warhead can detonate in close proximity to aircraft. The warhead fuse is damaged as missile is launched through ice in missile launcher. Gun barrels and breeches can rupture if gun muzzles are clogged with ice. The FFAR are held captive in the launcher tubes by the frozen ice.

CAUTION

When operating at FAT of 5°C (40°F) or below, icing of the engine air particle separator and FOD screens can be expected. Continued accumulation of ice will result in partial or complete power loss.

Continuous flight in light icing conditions is not recommended because the ice shedding induces rotor blade vibrations, adding greatly to the pilot's work load.

b. If icing conditions become unavoidable, the pilot shoud turn the PITOT HTR/ADS, ECS HTR and ENG DEICE switches on.

c. During icing conditions, one or all of the following can be expected to occur:

(1) Obscured forward field of view due to ice accumulation on the canopy. If the ECS fails to keep the canopy clear of ice, the side windows may be used for visual reference during landing.

(2) One-per-rotor-revolution vibrations ranging from mild to severe caused by asymmetrical ice shedding from the main rotor system. The severity of the vibration will depend upon the temperatures and the amount of ice accumulations on the blades when the ice shed occurs. The possibility of an asymmetric ice shed occurring increases as the outside air temperature decreases. Severe vibrations may occur as a result of main rotor asymmetrical ice shedding. If icing conditions are encountered while in flight, land as soon as practicable. All ice should be removed from the rotor system before attempting further flight.

(3) An increase in torque required to maintain a constant airspeed and altitude due to ice accumulation on the rotor system.

(4) Possible degradation of the ability to maintain autorotational rotor speed within operating limits.

d. Control activity cannot be depended upon to remove ice from the main rotor system. Vigorous control movements should not be made in an attempt to reduce low-frequency vibrations caused by asymmetrical shedding of ice from the main rotor blades. These movements may induce a more asymmetrical shedding of ice, further aggravating helicopter vibration levels.

e. If a 9-percent (or greater) torque pressure increase is required above the cruise torque setting used prior to entering icing conditions, it may not be possible to maintain autorotational rotor speed within operational limits, should an engine failure occur.

WARNING

Ice shed from the rotor blades and/or rotating components presents a hazard to personnel during landing and shutdown. Ground personnel should remain well clear of the helicopter during landing and shutdown passengers/crewmembers should not exit the aircraft until the rotor has stopped turning.

8-52. RAIN.

WARNING

Rain removal system does not remove rain in flight.

CHAPTER 9

EMERGENCY PROCEDURES

Section I. HELICOPTER SYSTEMS

9-1. HELICOPTER SYSTEMS.

This section describes the helicopter systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency operation of mission equipment is contained in this chapter insofar as its use affects safety of flight. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is contained in the condensed checklist, TM 55-1520-236-CL.

9-2. IMMEDIATE ACTION EMERGENCY STEPS.

WARNING

To obtain maximum protection from the restraint system during an emergency landing, each crewmember should place their shoulders against the seat back, manually lock the shoulder harness, and keep back straight.

NOTE

The urgency of certain emergencies requires immediate and instinctive action by the pilot. The most important single consideration is helicopter control. All procedures are subordinate to this requirement. The MASTER CAUTION should be reset after malfunction to allow systems to respond to subsequent malfunctions. If time permits during a critical emergency, transmit a MAY DAY CALL, set transponder to emergency, jettison external stores (if appropriate), and lock shoulder harnesses. Those steps that must be performed immediately in an emergency situation are underlined. These steps must be committed to memory and performed without reference to the checklist. Emergency situations with non-underlined steps may be accomplished with use of the checklist.

9-3. DEFINITION OF EMERGENCY TERMS.

For the purpose of standardization, these definitions shall apply.

a. The term "LAND AS SOON AS POSSIBLE" is defined as landing at the nearest suitable landing area (e.g., open field) without delay. (The primary consideration is to ensure the survival of occupants.)

b. The term "LAND AS SOON AS PRACTICABLE" is defined as landing at a suitable landing area. (The primary consideration is the urgency of the emergency.)

c. The term "AUTOROTATE" is defined as adjusting the flight controls as necessary to establish an autorotational descent and landing.

1. Collective - Adjust as required to maintain rotor RPM.
2. Pedals - Adjust as required.
3. Throttle- Adjust as required.
4. Airspeed - Adjust as required.

(0) 5. Wing stores - Jettison as appropriate.

d. The term "EMER SHUTDOWN" is defined as engine shutdown without delay.

1. THROTTLE - OFF.
2. FUEL switch - OFF.
3. BAT/BATTERY switch - OFF.

e. The term "EMER GOV OPNS" is defined as manual control of the engine RPM with the GOV AUTO/EMER switch in the EMER position. Because automatic acceleration, deceleration, and overspeed control are not provided with the GOV switch in the EMER position, throttle and collective coordinated control movements must be smooth to prevent compressor stall, overspeed, overtemperature, or engine failure.

CAUTION

No more than 78% torque is available in the EMER position due to limited fuel flow and may be significantly reduced based on ambient conditions.

1. GOV switch - EMER.
2. Throttle - Adjust as necessary to control RPM.
3. Land as soon as possible.

f. The term "JETTISON CANOPY" is defined as activation of the linear explosive canopy removal system to remove windows and separate doors from the helicopter. Emergency exits are shown in Figure 9-1.

1. Arming/firing mechanism handle - Turn 90°.
2. Arming/firing mechanism handle - Pull.

WARNING

Simultaneous or near simultaneous pulling of both the pilot's and gunner's arming/firing mechanism handle may result in injury to one or both of the crewmembers. The pilot must coordinate with the gunner prior to system firing.

9-4. AFTER EMERGENCY ACTION.

After a malfunction of equipment has occured, appropriate emergency actions have been taken and the helicopter is on the ground, an entry shall be made in the Remarks Section of DA Form 2408-13 describing the malfunction. Ground and flight operations shall be discontinued until corrective action has been taken.

9-5. EMERGENCY ENTRANCE.

Crew removal is accomplished through the crew doors or through the windows with crash rescue equipment.

9-6. EMERGENCY EQUIPMENT.

Emergency equipment consists of a fire extinguisher, first aid kit, and linear explosive canopy removal system. (Refer to Figure 9-1.) Wing store jettison capability is provided by explosive cartridges installed at each wing store pylon.

9-7. MINIMUM RATE OF DESCENT.

The speed for minimum rate of descent is 60 KIAS.

9-8. MAXIMUM GLIDE DISTANCE.

The speed for best glide distance is 100 KIAS (clean configuration) and 90 KIAS (wing stores).

9-9. ENGINE.

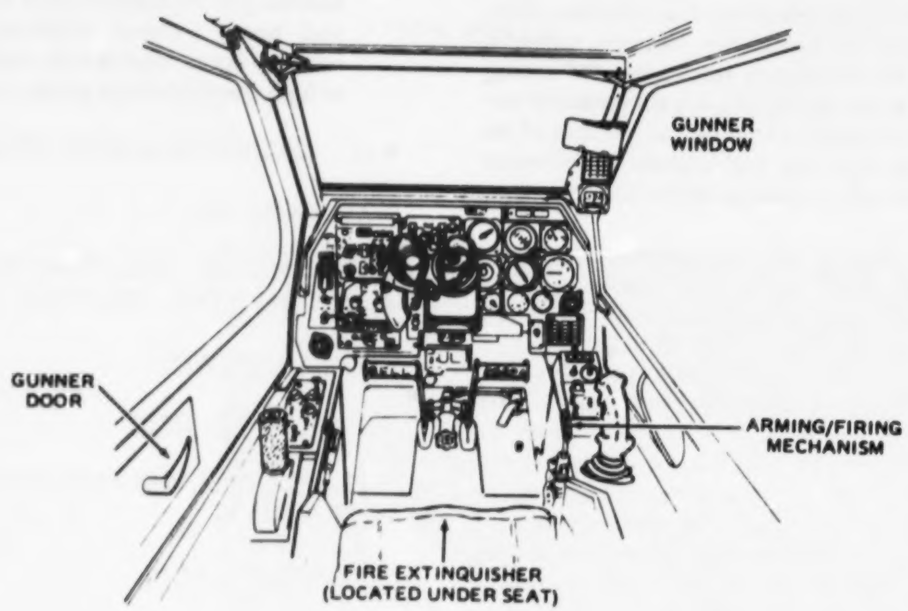
9-10. ENGINE MALFUNCTION-PARTIAL OR COMPLETE POWER LOSS.

a. The indications of an engine malfunction, either a partial or a complete power loss are left yaw, drop in engine rpm, drop in rotor rpm, drop in N1, low rpm audio alarm, illumination of rpm warning light, change in engine noise.

WARNING

Do not respond to the rpm audio and/or warning light illumination without first confirming engine malfunction by one or more of the other indications. Normal indications signify the engine is functioning properly and that there is a tachometer generator failure or an open circuit to the warning system, rather than an actual engine malfuntion.

b. Partial power loss. Under partial power conditions, the engine may operate relatively smoothly at reduced power or it may operate erratically with intermittent surges of power. A stabilization of the N1 should indicate a partial power condition. In instances where a power loss is experienced without accompanying power surging, the helicopter may sometimes be flown at reduced power to a favorable landing area. Under these conditions, the pilot should always be prepared for a complete power loss. In the event a partial power condition is accompanied by erratic engine operation or power surging, and flight is to be continued, perform EMER GOV operations. If continued flight is not possible, AUTOROTATE (throttle off).


GUNNER WINDOW
GUNNER DOOR
ARMING/FIRING MECHANISM
FIRE EXTINQUISHER (LOCATED UNDER SEAT)

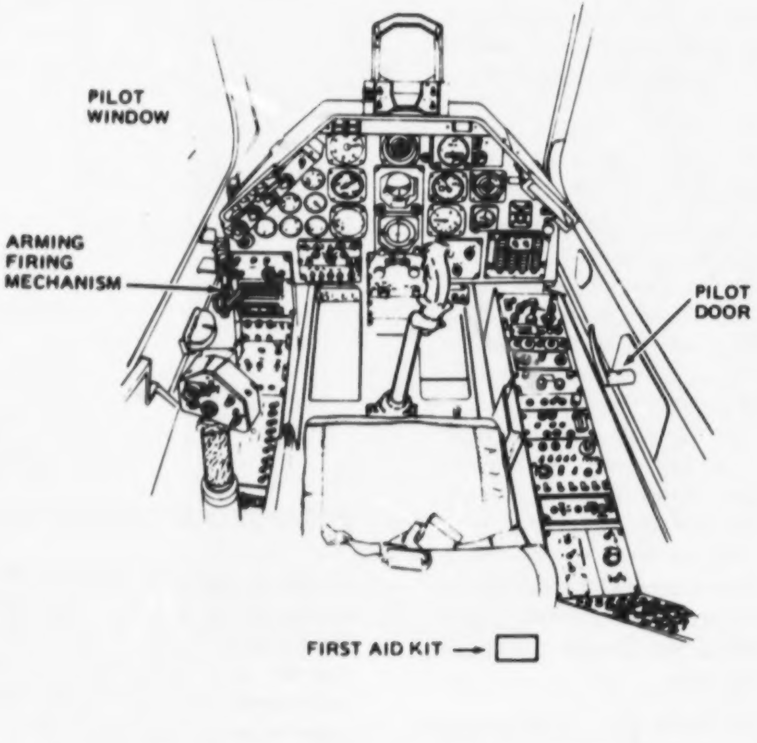

PILOT WINDOW
ARMING FIRING MECHANISM
PILOT DOOR
FIRST AID KIT → ☐

Figure 9-1. Emergency Exits and Equipment (Typical)

c. **Complete power loss.**

(1) Under a complete power loss condition, delay in recognition of the malfunction, improper technique or excessive maneuvering to reach a suitable landing area reduces the probability of a safe autorotational landing. Flight conducted within the caution area of the height-velocity chart (fig. 9-2) exposes the helicopter to a high probability of damage despite the best efforts of the pilot.

(2) From conditions of low airspeed and low altitude, the deceleration capability is limited, and caution should be used to avoid striking the ground with the tail rotor. Initial collective reduction will vary after an engine malfunction dependent upon the altitude and airspeed at the time of the occurrence. For example, collective pitch must not be decreased when an engine failure occurs at zero airspeed and approximately 15 feet; whereas, during cruise flight conditions, altitude and airspeed are sufficient for a significant reduction in collective pitch, thereby, allowing rotor rpm to be maintained in the safe operating range during autorotational descent. At high gross weights, the rotor may tend to overspeed and require collective pitch application to maintain the rpm below the upper limit. Collective pitch should never be applied to reduce rpm below normal limits for extending glide distance because of the reduction in rpm available for use during autorotational landing.

(3) Through a speed range of 120 to 190 KIAS, an engine failure will cause the nose of the helicopter to pitch up as a result of its aerodynamic qualities. The SCAS system detects this airframe movement and will attempt to correct with a forward cyclic control input, thereby causing serious rotor flapping and possible mast bumping. To prevent SCAS from making this correction there must be pilot input. In a nose-low attitude or level flight, the input should be aft cyclic movement. In a nose-high attitude, such as dive pullout, the input should be a forward cyclic movement. During the recovery from a high-speed engine failure, the important point to remember is to maintain the necessary rotor rpm and movement to keep the rotor system loaded. Speed should be reduced to successfully reach the intended landing area. After entering autorotation, follow standard autotoration procedures. Do not exceed 120 KIAS in sustained autorotation.

CAUTION

Engine failure at 150 KIAS and greater requires a pilot recognition and reaction time of less than one second to preclude unacceptable high left roll rates. Heavy buffeting of the tailboom and vertical fin and heavy control feedback during recovery are associated with engine failure at high speed and high power conditions.

9-11. ENGINE MALFUNCTION - HOVER.

AUTOROTATE

9-12. ENGINE MALFUNCTION - LOW ALTITUDE/LOW AIRSPEED OR CRUISE.

1. AUTOROTATE.
2. EMER GOV OPNS.

9-13. ENGINE MALFUNCTION - 120 KIAS AND ABOVE.

1. CYCLIC - Adjust.
2. AUTOROTATE.
3. EMER GOV OPNS.

9-14. Deleted.

9-15. DROOP COMPENSATOR FAILURE.

Droop compensator failure will be indicated when engine rpm is no longer controlled by application of collective pitch. The engine will tend to overspeed as collective pitch is decreased and will underspeed as collective pitch is increased. If the droop compensator fails, make minimum collective movements and execute a shallow approach to the landing area. If unable to maintain the operating RPM within limits:

HEIGHT VELOCITY DIAGRAM

100% RPM

EXAMPLE A

WANTED

MINIMUM AIRSPEED TO REMAIN OUTSIDE AVOID AREA

KNOWN

DENSITY ALITIUDE= 5500 FEET
SKID HEIGHT ABOVE GROUND= 400 FEET

METHOD

ENTER SKID HEIGHT HERE
MOVE RIGHT TO 5500
MOVE DOWN. READ INDICATED AIRSPEED= 55 KNOTS

EXAMPLE B

WANTED

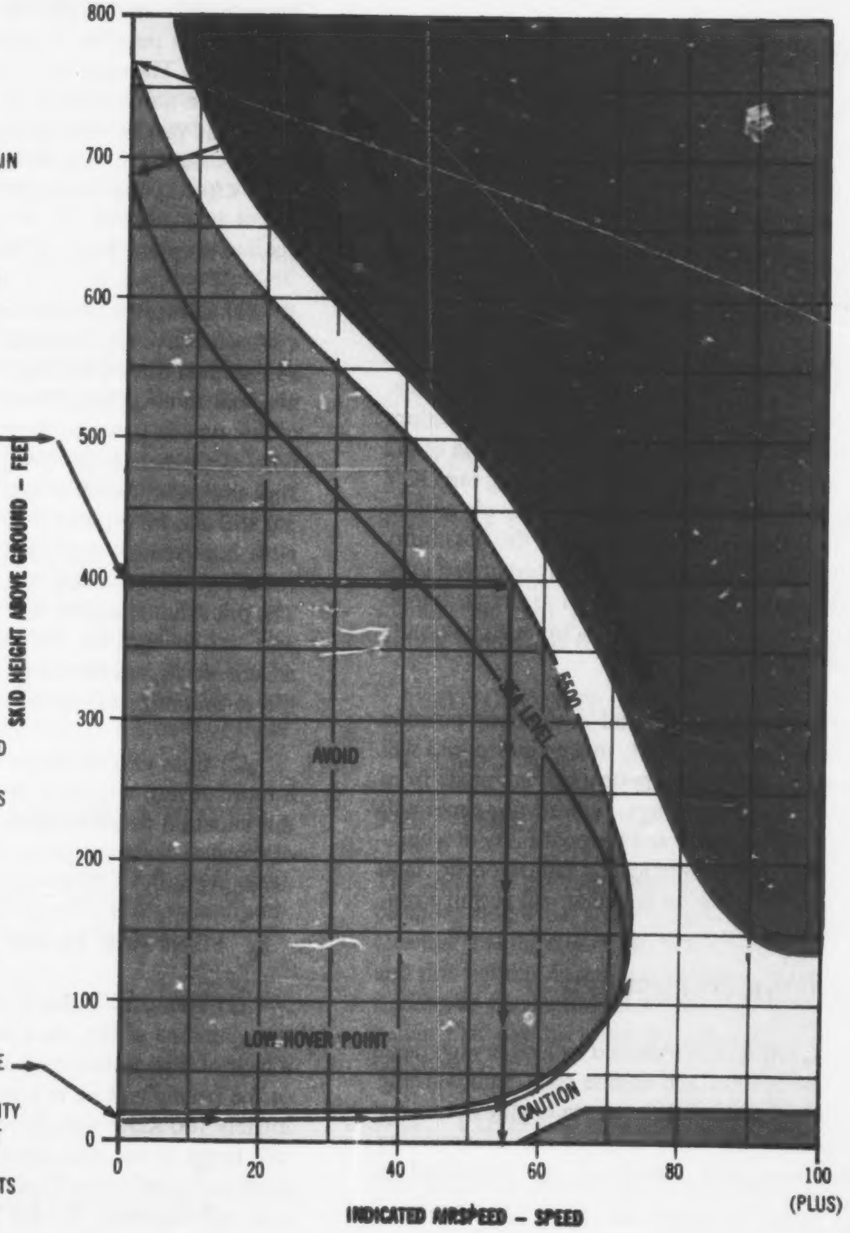
MINIMUM INDICATED AIRSPEED FOR CLIMB OUT TO AVOID HEIGHT VELICITY RESTRICTIONS

KNOWN

DENSITY ALTITUDE= 5500 FEET
LOW HOVER POINT= 20 FEET SKID HEIGHT ABOVE GROUND

METHOD

ENTER DENSITY ALTITUDE HERE (AT LOW HOVER POINT)
MOVE RIGHT ALONG THE DENSITY ALTITUDE LINE TO THE FASTEST AIRSPEED MOVE DOWN READ INDICATED AIRSPEED =73 KNOTS



DATA BASIS: DERIVED FROM FLIGHT TEST USE ASTA 69 - 13. FEBRUARY 1971

FIGURE 9-2. Height Velocity Diagram

EMER GOV OPNS.

9-16. ENGINE COMPRESSOR STALL.

Engine compressor stall (surge) is characterized by a sharp rumble or loud sharp reports, severe engine vibration, and a rapid rise in turbine gas temperature, depending on the severity of the surge. Maneuvers requiring rapid or maximum power applications should be avoided. Shoud this occur:

1. Collective - Reduce.
2. HTR/RAIN RMV or ECU switch - OFF.
3. DE-ICE switch - OFF.
4. Land as soon as possible.

9-17. INLET GUIDE VANE ACTUATOR FAILURE.

a. If the guide vanes fail in the closed position, a maximum of 35-44 percent of torque will be available. Although N1 may indicate normal, power applications above 35-44 percent will result in deterioration of N2 and rotor rpm while increasing N1. Placing the GOV switch in the EMER position will not provide any increased power capability and increases the possibility of an N1 overspeed and an engine overtemperature. Should a failure occur, land as soon as practicable to an area that will permit a run-on landing with minimum power applications.

b. If the inlet guide vanes fail in the open position during normal flight, it is likely that no indications will be experienced. As power applications are made from increasingly lower N1 settings, acceleration times will correspondingly increase, and the possibility of a compressor stall is likely. Should this failure occur, land as soon as practicable to an area that will permit a run-on landing.

9-18. ENGINE OVERSPEED.

Engine overspeed will be indicated by a right yaw, rapid increase in both rotor and engine rpm, rpm warning light illuminated, and an increase in engine noise. An engine overspeed may be caused by a malfunctioning N2 governor or fuel control. If an overspeed is experienced:

1. Collective - Increase to load the rotor in an attempt to maintain rpm below the maximum operating limit.
2. Throttle - Reduce to normal operating rpm. If rpm cannot be controlled:
3. EMER GOV OPNS.

9-19. ROTORS, TRANSMISSION, AND DRIVE SYSTEMS.

9-20. TAIL ROTOR FAILURE - FLIGHT.

Because of the many different malfunctions that can occur, it is not possible to provide a solution for every emergency. The success in coping with the emergency depends on quick analysis of the condition and selection of the proper emergency procedure. The following is a discussion of some types of malfunctions, probable effects, and corrective actions.

a. Complete Loss of Thrust Components.

(1) Complete Loss of Tail Rotor Thrust. This is a situation involving a break in the drive system, such as a severed driveshaft, wherein the tail rotor stops turning and no thrust is delivered by the tail rotor. A failure of this type in powered flight will usually result in the nose of the helicopter swinging to the right (left side slip) and usually a roll of the fuselage. Nose down tucking will also be present. The most advisable procedure is to immediately AUTOROTATE (throttle off) and coordinate the resulting maneuver with cyclic control. The pilot should expect that some rotation will be present until touchdown. Touchdown should be in as level an attitude as possible and ground speed as low as possible to minimize turnover.

(2) Loss of Tail Rotor Components. Except for a more severe nose tuck due to the forward cg shift, this situation would be quite similar to a complete loss of thrust as discussed above. When a loss of components is suspected, AUTOROTATE (throttle off).

b. Fixed Pitch Failure.

(1) General. Failures of this type (wedged control, jammed slider, etc.) are characterized by either a lack of directional response when a pedal is pushed or the pedals will be in a locked position. At approximately 100 KIAS and above, the cambered vertical fin will begin to become more effective and as a result, a left yaw condition will increase and conversely, a right yaw will decrease. To aid in directional control, the rpm may be decreased with the throttle until rpm is controlled manually. Increasing the throttle and/or collective will move the nose to the right, decreasing the throttle and/or collective will move the nose to the left.

WARNING

If the pedals cannot be moved with a moderate amount of force, do not attempt a maximum effort since a more serious malfunction and set of circumstances could result.

(2) Left fixed pitch. If it has been determined the tail rotor pitch is fixed in a left pedal applied position, an autorotative landing should not be attempted. The pilot should use only that power necessary to produce a controllable degree of side slip and continue to the nearest suitable landing area. To accomplish a landing, establish a powered approach with an airspeed that will allow a desirable rate of descent without producing an uncomfortable left yaw attitude and right sideslip condition. Just prior to landing, adjust throttle and collective as necessary to align the helicopter with touchdown.

(3) Right fixed pitch. If the tail rotor becomes fixed during cruise flight or a reduced-power situation, the helicopter will yaw to the right when power is increased. For either of these situations, a running type landing can be performed. If the right yaw becomes excessive when adding power at touchdown, reduce the throttle and cushion the landing with collective. The greatest problem is the compromise that may have to be made between rate of descent and yaw attitude since the collective is the primary control for both of these parameters.

9-21. TAIL ROTOR FAILURE - HOVER.

a. If the tail rotor pitch is fixed in a left pedal position, simultaneously reduce throttle and gradually increase collective pitch to land the helicopter.

b. If total loss of tail rotor thrust/fixed right pedal is experienced:

1. Throttle - Reduce.
2. AUTOROTATE.

9-22. MAIN DRIVESHAFT FAILURE.

A failure of the main driveshaft will be indicated by a left yaw (this is caused by the drop in torque applied to main rotor), increase in engine rpm, decrease in rotor rpm, low rpm audio alarm, and illumination of the rpm warning light. This condition will result in complete loss of power to the rotor and a possible engine overspeed. If a failure occurs:

1. AUTOROTATE.
2. Throttle - Off.

9-23. TRANSMISSION SPRAG CLUTCH MALFUNCTION.

9-24. CLUTCH FAILS TO DISENGAGE

A clutch failing to disengage in flight will be indicated by the rotor rpm decaying with engine rpm as the throttle is reduced to the engine idle position when entering autorotational descent. This condition results in total loss of autorotational capability. If a failure occurs, do the following:

1. Throttle - On.
2. Land as soon as possible.

9-25. CLUTCH FAILS TO RE-ENGAGE.

During recovery from autorotational descent, clutch malfunction may occur and will be indicated by a reverse needle split (engine rpm higher than rotor rpm).

1. AUTOROTATE.
2. Throttle - Off.

9-26. FIRE.

The safety of the helicopter occupants is the primary consideration when a fire occurs. On the ground, it is essential that the engine be shut down, crew evacuated, and fire fighting begun immediately. If the helicopter is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land the helicopter.

9-27. FIRE-ENGINE START.

The following procedure is applicable during engine starting if TGT limits are exceeded, or if it becomes apparent that they will be exceeded. Flames emitting from the tailpipe are acceptable if the limits are not exceeded.

1. Throttle - OFF.

2. FUEL switch - OFF.

3. Start switch - Press until TGT is in the normal operating range.

9-28. FIRE-GROUND.

a. Pilot's station.

EMER SHUTDOWN.

b. Gunner's station.

1. IDLE STOP - RELEASE and hold.

2. Throttle - OFF.

3. EMER ELEC PWR switch - EMERG OFF.

9-29. FIRE-FLIGHT.

If the fire light illuminates and/or fire is observed during flight, prevailing circumstances (such as VFR, IMC, night, altitude, and landing areas available), must be considered in order to determine whether to execute a power-on (max Vne), or a power-off landing (max - 120 KIAS).

a. Power-On.

1. Land as soon as possible.

2. EMER SHUTDOWN.

b. Power-Off.

1. AUTOROTATE.

2. EMER SHUTDOWN.

9-30. ELECTRICAL FIRE-FLIGHT.

Prior to shutting off all electrial power, the pilot must consider the equipment that is essential to a particular flight environment that will be encountered; e.g., flight instruments and fuel boost pumps. In the event of electrical fire of suspected electrical fire in flight:

1. BAT/BATTERY switch - ON/START.

2. Electrical switches - OFF.

3. NON-ESNTL BUS switch - NORMAL.

4. Land as soon as possible.

5. EMER SHUTDOWN.

If landing cannot be made as soon as possible and flight must be continued, the defective circuits may be identified and isolated. Electrical switches should be turned ON one at a time in the priority required. When malfunctioning circuit is identified, turn switch off.

9-31. FUMES FROM ECS.

If fumes are emitted in the cockpit from the ECS System:

1. ECS - OFF.

If fumes continue.

2. Land as soon as possible.

9-32. SMOKE AND FUME ELIMINATION.

Vents - Open.

9-33. SINGLE OR DUAL FUEL BOOST PUMP FAILURE.

Continued flight below 6000 feet or less pressure altitude is permitted.

Single or dual pump failure.

1. Fuel switch - ON.

2. Pump circuit breaker(s) - OUT.

3. Land as soon as practicable.

CAUTION

Nose-down attitudes greater than 15 degrees should be avoided because engine failure may occur due to fuel starvation when the forward fuel boost pump is inoperable and with less than 320 pounds of fuel remaining.

9-34. ELECTRICAL SYSTEM.

9-35. DC GENERATOR FAILURE -DC CAUTION LIGHT ILLUMINATION.

NOTE

As battery voltage is depleted there is a possibility of activation of the RPM warning light and RPM audio systems.

1. GEN BUS RESET/GEN FIELD circuit breakers - IN.
2. GEN switch - Move to RESET then to GEN position.

If generator is not restored, continue as follows:

3. GEN switch - OFF.
4. TCP MODE SEL switch - OFF.
5. Switches - OFF for unused equipment.
6. NON ESNT BUS switch - As required.

9-36. P AC INVERTER FAILURE - CAUTION LIGHT ILLUMINATION.

1. INV MAIN/STBY circuit breakers - In.
2. INV switch - STBY.
3. SCAS - Re-engage.

9-37. EM ALTERNATOR FAILURE - ALTER AND RECT CAUTION LIGHT ILLUMINATION.

1. ALTNR switch - OFF RESET, then ON.

If alternator is not restored:

2. ALTNR - OFF RESET.
3. Land as soon as possible.

9-38. EM TRANSFORMER RECTIFIER UNIT (TRU) FAILURE - RECT CAUTION LIGHT ILLUMINATION.

1. ALTNR switch - OFF reset.
2. ALTNR switch - ON.

9-39. OVERHEATED BATTERY.

If overheated battery is suspected or detected proceed as follows:

1. BAT/BATTERY switch - OFF.
2. Land as soon as possible.
3. EMER SHUTDOWN.

WARNING

Do not open battery compartment and attempt to disconnect or remove overheated battery fluid will cause thermal burns and may explode.

9-40. HYDRAULIC SYSTEM FAILURE.

If a hydraulic malfunction should occur below an airspeed of 40 KIAS, the pilot should turn on the emergency hydraulic pump (as appropriate) and land the aircraft as soon as possible. If terrain does not permit a landing, accelerate the aircraft to the best controllable airspeed above 40 KIAS and comply with the appropriate failure that has occurred.

WARNING

The ability to increase collective (Torque) may be limited during a single system failure and will be limited during a dual system failure. Collective once lowered may not be able to be raised again; if altitude cannot be maintained, jettison wing stores as appropriate.

Generator failure and/or EM alternator/rectifier failure combined with hydraulic failure will allow not more than five minutes of operating time of the emergency hydraulic pump.

During a single system failure, do not move hydraulic test switch to failed system position. Hydraulic pressure to good system will be interrupted.

9-41. HYDRAULIC FAILURE - SINGLE SYSTEM.

Loss of system No. 1 will result in loss of tail rotor servo and the yaw SCAS actuator. Loss of No. 2 hydraulic system will result in loss of pitch and roll SCAS actuators. Cyclic and collective control feedback may be evident during abrupt maneuvers.

1. EMER HYDR PUMP switch - OFF (Pilot and gunner).
2. HYD CONT/CONTR circuit breaker - In.
3. EMER HYDR/HYD PUMP circuit breaker - In.
4. SCAS - DISENGAGE appropriate channels.
    a. No. 1 system - Yaw channel.
    b. No. 2 system - Pitch and roll channels.
5. MASTER ARM switch - OFF.
6. Land as soon as practicable. A run-on landing at a speed of 50 KIAS or above is recommended.

7. EMER HYDR PUMP switch - EMER HYDR PUMP (final approach).

NOTE

P The turret will return to the stow position in elevation but will not stow in azimuth.

9-42. HYDRAULIC FAILURE - DUAL SYSTEM.

Loss of both hydraulic systems will result in loss of hydraulic pressure to the SCAS actuators, cyclic, collective, and tail rotor servos.

WARNING

During power application above 60 percent, roll oscillations may become unmanageable. If oscillations become severe, reduce collective until oscillations are manageable. Below 40 KIAS cyclic feedback forces become unmanageable.

NOTE

P The turret will return to the stow position in elevation but will not stow in azimuth.

1. EMER HYDR PUMP switch - OFF (pilot and gunner).

2. HYD CONT/CONTR and circuit breaker - In.

3. EMER HYDR/HYD PUMP circuit breaker - In.

4. SCAS - Disengage all channels.

5. MASTER ARM switch - OFF.

6. Land as soon as practicable. A run-on landing at a speed of 50 KIAS or above is recommended.

7. EMER HYDR PUMP switch - EMER HYDR PUMP (final approach).

NOTE

When the collective pitch creeps down, turn the EMER HYDR PUMP switch on and increase collective as required; then, turn the system off. This procedure can be repeated as required. During emergency hydraulic pump operation, collective movement may be slower than normal.

9-43. LANDING AND DITCHING.

9-44. LANDING IN TREES.

A landing in trees should be made when no other landing area is available. Select a landing area containing the least number of trees of minimum height. Decelerate to zero ground speed at tree-top level and descend into the trees vertically, applying collective pitch as necessary for minimum rate of descent. Prior to the main rotor blades entering the tree, ensure throttle is off and apply all of the remaining collective pitch.

9-45. DITCHING - POWER ON.

If it becomes necessary to ditch the helicopter, accomplish an approach to an approximate 3-foot hover above the water and proceed as follows:

1. MASTER ARM - OFF.

2. PLT OVRD/OVRIDE - OFF.

3. JETTISON CANOPY.

4. Gunner - Exit.

NOTE

Correct for cg shift of 2.5 to 4.0 inches when gunner exits helicopter.

5. Hover - Clear of gunner.

WARNING

Life preserver should not be inflated until clear of helicopter.

6. Throttle - Off and autorotate. Apply full collective pitch prior to the main rotor blades entering the water. Maintain a level attitude as the helicopter sinks and until it begins to roll, then apply cyclic in direction of the roll. Pilot should exit when main rotor stops.

9-46. DITCHING - POWER OFF.

If ditching is imminent, accomplish engine malfunction emergency procedures. Decelerate to zero forward speed, level helicopter and jettison canopy just prior to entering the water. Apply collective pitch as the helicopter sinks and until it begins to roll, then apply cyclic in the direction of the roll. Exit when the main rotor is stopped.

NOTE

> There may be a tendency to decelerate too high over water due to depth perception.

9-47. FLIGHT CONTROL/MAIN ROTOR SYSTEM MALFUNCTIONS.

a. Failure of components within the flight control system may be indicated through varying degrees of feedback, binding, resistance, or sloppiness. These conditions should not be mistaken for hydraulic power failure.

b. Imminent failure of main rotor components may be indicated by a sudden increase in main rotor vibration and/or unusual noise. Severe changes in lift characteristics and/or balance condition can occur due to blade strikes, skin separation, shift or loss of balance weights or other material. Malfunctions may result in severe main rotor flapping. In the event of a main rotor system malfunction, proceed as follows:

WARNING

Danger exists that the main rotor system could collapse or separate from the aircraft after landing. A decision must be made whether occupant egress occurs before or after the rotor has stopped.

1. Land as soon as possible.

2. EMER SHUTDOWN.

9-48. MAST BUMPING.

If mast bumping occurs:

1. Reduce severity of maneuver.

2. Land as soon as possible.

9-49. STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS) FAILURE.

A failure of the SCAS will be evident by an abrupt change in pitch, roll, and/or yaw attitude which, when corrected by the pilot, will result in an abnormal cyclic or pedal position. When SCAS is disengaged, a second correction may be required by the pilot to return level flight. Mast bumping may occur. SCAS off flight is limited to 100 KIAS MAXIMUM. Additionally, high power settings should be avoided when operating at airspeeds between 60 and 100 KIAS with inoperative roll and yaw SCAS channel because in instability. If a failure occurs, proceed as follows:

1. SAS REL button - Press.

If condition persists.

2. SCAS POWER switch - OFF.

3. Unaffected SCAS channels - re-engage only if power switch has not been turned off.

4. Land as soon as practicable.

9-50. BAILOUT PROCEDURES.

1. FORCE TRIM switch - TRIM.

2. Attitude - Attempt to stabilize helicopter in a shallow descent at approximately 80 KIAS.

3. JETTISON CANOPY.

WARNING

Delay opening parachute until well clear of helicopter.

4. Bailout.

Section II. MISSION EQUIPMENT

9-51. WING STORES EMERGENCY JETTISON.

a. Pilot Wing Stores Jettison Procedures.

1. JETTISON SELECT switches - As required.

2. JETTISON switch - Press.

b. Gunner Wing Stores Jettison Procedures.

1. JTSN SEL switch - As required.

2. WING STORES JETTISON switch - Up.

9-52. TOW MISSILE EMERGENCY PROCEDURES.

a. Hangfire/misfire.

1. After landing - Ensure weapons are pointed at safe area.

2. Armament switches - OFF.

3. Engine shutdown.

4. Helicopter - Exit 90 degrees from line of fire.

b. Emergency Wire Cut. Should a power loss occur to the TOW system which causes the M65 to momentarily shut down, the system will automatically return to a ready-to-fire mode. If the TCP MODE SELECT switch is in ARMED MAN, then the gunner must press his WIRE CUT to sever the wires to the missile. If the TCP MODE SELECT switch is in ARMED AUTO, the gunner must reset the TCP MODE SELECT switch to manual and turn the MISSILE SELECT switch just fired and then press the WIRE CUT switch to sever wires to the missile just fired. If wire fails to cut, fly helicopter in a crab away from the wire. Approach and landing should be made in a crab to prevent entangling wire with helicopter.

WIRE CUT switch - Press.

c. TOW Missile Flight Motor Failure.

WIRE CUT switch - Press.

d. TOW Missile Erractic in Flight.

1. Attempt to keep missile down range.

2. Emergency wire cut if needed.

9-53. RUNAWAY GUN.

1. MASTER ARM switch - OFF.

2. PLT OVRD/ORIDE switch - OFF.

Table 9-1. Emergency Procedures for Caution Segments (Pilot and Gunner Caution Panels)

Light	Corrective Action
MASTER CAUTION	(No segment light.) Land as soon as possible.
ENG/ENGINE OIL PRESS	Land as soon as possible.
XMSN/TRANS OIL PRESS	Land as soon as possible.
ENG OIL BYPASS	Land as soon as possible.
XMSN/TRANS OIL BYPASS	Land as soon as possible.
XMSN OIL HOT/XMSN OIL TEMP/TRANS OIL HOT	Land as soon as possible.
ENG FUEL PUMP	Land as soon as possible.
ENG CHIP	Land as soon as possible.
XMSN/TRANS, 42°, 90° CHIP	Land as soon as possible.
CHIP DETECTOR	Land as soon as possible.
FWD FUEL BOOST	Refer to emergency procedure.
FUEL FILTER	Land as soon as possible.
FUEL LOW	Information/system status.
AFT FUEL BOOST	Refer to emergency procedure.
DC GEN	Refer to emergency procedure.
MAIN INVTR	Refer to emergency procedure.
RECT	Information/system status.
STBY INVTR	Information/system status.
ALTER	Refer to emergency procedure.
EXT PWR	Close door.
GOV EMER/EMERG	Information/system status.
IFF CODE HOLD	Information/system status.
IFF CAUTION	Information/system status.
HYD PRESS #1/#1 HYD PRESS	Refer to emergency procedure.
EMER HYDR PUMP ON	Information/system status.
HYD PRESS #2/#2 HYD PRESS	Refer to emergency procedure.
SPARE	Land as soon as possible.
GUN ELEV STOWED	Information/system status.
HUD INOP	Information/system status.
FCC INOP	Information/system status.
LASER ARMED	Information/system status.
IRCM INOP	Information/system status.

APPENDIX A

REFERENCES

AR 70-50	Designating and Naming Military Aircraft, Rockets, and Guided Missiles
AR 95-1	Army Aviation General Provisions and Flight Regulations
AR 95-16	Weight and Balance — Army Aircraft
AR 385-40	Accident Reporting and Records
DA PAM 738-751	The Army Maintenance Management System (TAMMS)
FC 1-213	Aircrew Training Manual
FM 1-202	Environmental Flight
FM 1-203	Fundamentals of Flight
FM 1-204	Night Flight Techniques and Procedures
FM 1-230	Meteorology for Army Aviation
FM 1-240	Instrument Flying and Navigation for Army Aviators
FM 10-68	Aircraft Refueling
TB MED 501	Noise and Conservation of Hearing
TM 9-1005-257-12	Operator and Organizational Maintenance; Armament Pod, Aircraft 7.62MM Machine Gun: M18 and M18A1
TM 9-1055-460-14	Operator, Organizational, Direct Support, General Support Maintenance: 2.75 Inch Aircraft Rocket Launcher M158A1, M200, and M200A1
TM 9-1090-203-12	Operator and Organizational Maintenance: Armament Subsystem, Helicopter, 7.62MM Machine Gun — 40MM Grenade Launcher, M28 and M28E1
TM 9-1090-203-12-2	Operator and Organizational Maintenance: Armament Subsystem, Helicopter, 7.62MM Machine Gun — 40MM Grenade Launcher, M28A1E2
TM 9-1090-206-12	Aviation Unit Maintenance Manual for Armament Subsystem, Helicopter 20MM Automatic Gun: XM97E1
TM 9-1090-207-13 & P	Aviation Unit and Intermediate Maintenance Manual With Repair Parts and Special Tools List (RPSTL) (Including Depot Maintenance Repair Parts and Special Tools) for Stores Management
TM 9-1270-212-14	Operator, Organizational, and Direct Support Maintenance Manual for XM128 and XM136 Helmet Sight Subsystem (HSS)
TM 9-1425-473-20	Organizational Maintenance Instructions Armament Subsystem, Helicopter, TOW Guided Missile XM65
TM 55-1500-342-23	Army Aviation Maintenance Engineering Manual — Weight and Balance (formerly TM 55-405-9)

TM 55-1520-236-CL	Operators and Crewmembers Checklist — AH-1P/E/F Helicopter
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use
DOD FLIP	DOD Flight Information Publication (Enroute)
FAR Part 91	Flight Air Regulation Part 91

APPENDIX B

ABBREVIATIONS AND TERMS

AADS	Airspeed and Direction Sensor
ACQ	Acquire
ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
ADS	Air Data Subsystem, Fire and Flight
AGL	Above Ground Level
ALT	Airborne Laser Tracker
ALT	Altitude
AM	Amplitude Modulation
ANT	Antenna
AVAIL	Available
BAT	Battery
BFO	Beat Frequency Oscillator
BIT	Built-In-Test
BRG PTR	Bearing Pointer
C	Celsius
CAS	Calibrated Airspeed
CARR	Carrier
CCW	Counter Clockwise
CG	Center of Gravity
CHAN	Channel
CL	Centerline
CONFIG	Configuration
CONT	Continuous
CONT	Control
CW	Clockwise
DECR	Decrease
DELTA △	Incremental Change
DG	Directional Gyro
DSCRM	Discriminator
ECAS	Enhanced Cobra Armament System
ECS	Environmental Control System
EIA	Electronic Interface Assembly
EMER	Emergency
END	Endurance
F	Fahrenheit
FAT	Free Air Temperature
FCC	Fire Control Computer
FFAR	Folding Fin Aerial Rocket
FLT	Flight
FM	Frequency Modulation
FOD	Foreign Object Damage
FPS	Feet Per Second
FT	Foot
FT/MIN	Feet Per Minute
FWD	Forward
△F	Increment of Equivalent Flat Plate Drag Area

GACP	Gunner Accuracy Control Panel
GAL	Gallon
GAL/HR	Gallon Per Hour
GD	Guard
GHS	Gunner Helmet Sight
GND	Ground
GNR	Gunner
GRWT	Gross Weight
GW	Gross Weight
GYRO	Gyroscope
HDG	Heading
HP	Horsepower
HR	Hour
HSI	Horizontal Situation Indicator
HSS	Helmet Sight Subsystem
HTR	Heater
HUD	Heads Up Display
HVY HOG	Heavy Hog
HYDR	Hydraulic
Hz	Hertz
IAS	Indicated Airspeed
ICDU	Integrated Control and Display Unit
ICS	Interphone Control Station
IFF	Identification Friend or Foe
IGE	In Ground Effect
IN	Inch
INCR	Increase
IND	Indication
IN HG	Inches of Mercury
INV	Inverter
IR	Infrared
JTSN	Jettison
KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KM	Kilometer
KTAS	Knots True Airspeed
KN	Knots
KVA	Kilovolt-Ampere
LB	Pounds
LAI	Low Airspeed Indicator
LB/HR	Pounds Per Hour
LHG	Left Hand Grip
LIM	Limit
LOS	Line of Sight
LRF	Laser Range Finder
LTG	Lights
M	Modernized Cobra
MAG	Magnetic
MAN	Manual
MAX	Maximum
MHF	Medium - High Frequency
MHz	Megahertz
MIC	Microphone
MIN	Minimum
MIN	Minute
MM	Millimeter

MOD	Modified
MSI	Missile Status Indicator
NAV	Navigation
NO	Number
NM	Nautical Mile
NORM	Normal
NVG	Night Vision Goggles
N1	Gas Turbine Speed
N2	Power Turbine Speed
OGE	Out of Ground Effect
ORIDE	Override
OVRD	Override
PHS	Pilot Helmet Sight
PLT	Pilot
PRESS	Pressure
PSI	Pounds Per Square Inch
PSI	Pilot Steering Indicator
PVT	Private
PWR	Power
% Q	Percent Torque
R/C	Rate of Climb
RCVR	Receiver
R/D	Rate of Descent
RMI	Radio Magnetic Indicator
RPM	Revolutions Per Minute
RKT	Rocket
RMS	Rocket Management Subsystem
RTCL	Reticle
SAS	Stability Augmentation System
SCAS	Stability and Control Augmentation System
SECU	Servo Electronic Control Unit
SEL	Select
SIF	Selected Identification Features
SHC	Sight Hand Control
SPEC	Specification
SQ	Squelch
STA	Station
STBY	Standby
SQ FT	Square Feet
TAS	True Airspeed
TCP	TOW Control Panel
TGT	Turbine Gas Temperature
TML	TOW Missile Launcher
TMS	TOW Missile System
TOW	Tube-Launched, Optically-Tracked, Wire Command Link
T/R	Transmit-Receive
TRK	Track
TRQ	Torque
TSU	Telescopic Sight Unit
UHF	Ultra-High Frequency
USAASTA	United States Army Aviation Systems Test Activity
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VHF	Very High Frequency

VIGV	Variable Inlet Guide Vane
VOL	Volume
VOR	VHF Omnidirectional Range
V_{NE}	Velocity, Never Exceed (Airspeed Limitation)
VSI	Vertical Speed Indicator
WG STA	Wing Station
WPN	Weapon
XMTR	Transmitter
XMSN	Transmission
XPDR	Transponder

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By Order of the Secretary of the Army:

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FT. LEONARD WOOD MO 63108

DATE

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DATE: 11 Jan 80

TITLE: Operator's Manual AH-1S (PROD), AH-1S (ECAS) + AH-1S (MC)

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6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gaskit but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

TEAR ALONG DOTTED LINE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER: JOHN DOE, PFC (268) 317-7111

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimenter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 38.82 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimenter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
square inches	square centimeters	6.451
square feet	square meters	.093
square yards	square meters	.836
square miles	square kilometers	2.590
acres	square hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29,573
pints	liters	.473
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound-feet	newton-meters	1.365
pound-inches	newton-meters	.11375

To change	*To*	*Multiply by*
ounce-inches	newton-meters	.007062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
square centimeters	square inches	.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
liters	gallons	.264
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C